VIDEOS, AUDIO CLIPS, AND TEXT MATERIALS: AN INVESTIGATION OF MEDIA USE IN PSYCHOLOGY LEARNING

BY

CRYSTAL CARLSON

DISSERTATION

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Doctoral Committee:

Professor Michelle Perry, Chair
Associate Professor Sarah Grison, Parkland College
Associate Professor Wen-Hao Huang
Assistant Professor Robb Lindgren

ABSTRACT

A variety of media are used in undergraduate psychology education—from the traditional text materials to videos. Research has identified multimedia materials, those that convey information through words and pictures, as particularly helpful for learning (e.g., Mayer, 1989; Mayer & Anderson, 1991), but it is not clear in what context multimedia are superior over single-medium materials. It is also unclear how experiences with all media can be supported to ensure learners understand the relevant information conveyed. The wide range of multimedia materials available and the unique nature of different content within psychology create a complex issue worthy of more research. The first two studies discussed herein use videos commonly used in Introduction to Psychology courses and compare learning outcomes of those videos as compared to their single-medium formats. The second study also investigates the impact of instructional support (i.e., advance organizers) on learning outcomes for each medium. The third study focuses on a different type of video used in Introduction to Psychology courses and examines the impact of two instructional supports (i.e., advance organizers and guidance embedded in the video) on learning outcomes. Findings suggest students perform well when taught through multimedia as well as single-medium formats for both retention and application instructional goals. However, advance organizers that emphasize key concepts and encourage note-taking prove to be particularly helpful for instruction that is in audio-only or text-only formats. Implications for media use and design in psychology instruction are discussed.

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CHAPTER 1

INTRODUCTION

Educators and learners have more technology available to them than ever before. Among the many benefits of technology is the ability to quickly access information in any content area. Additionally, the variety of media available on any topic is vast. This allows teaching and learning to extend beyond the traditional textbook in favor of rich multimedia learning materials. For example, animations, videos, games, etc. can all communicate information in any content area through the engaging combinations of words and images. However, the benefits of such multimedia as compared to single-medium materials remain unclear.

Research in this area has emphasized that although technology affords endless possibilities in the design and delivery of multimedia, this potential does not always overlap with learners' needs (Clark & Mayer, 2011; Holland & Holland, 2014; Mayer, 2009). Simply presenting multimedia doesn't ensure learning goals are met and, in some cases, having too much information presented to the learner can negatively impact learning, suggesting single-medium materials may be better choices or just as good as their multimedia alternatives (Craig, Gholson, & Driscoll, 2002; Jamet & LeBohec, 2007; Lehman, Schraw, McCrudden, & Hartley, 2007; Moreno & Mayer, 2002). For meaningful learning to occur, technology capabilities need to be aligned with learners' needs and content area learning goals. To do this, researchers need to better understand the affordances and challenges of the media themselves and how specific content areas impact their effectiveness.

Continued research in this area also has practical benefits. Because of their appeal, it is unlikely educators will stop using multimedia materials. It is also unlikely educators will stop using textbooks or other largely single-medium materials, given their practicality and the amount

of information they convey. In light of these practical considerations, it is important to be mindful of the affordances and challenges of all these materials for learners. This knowledge can help educators make better choices about the design and delivery of both multimedia and single-medium materials. Before discussing the three studies completed for this dissertation, I will provide an overview of multimedia research and factors that may moderate the impact of multimedia on learning.

Multimedia and Single-Medium Comparisons

Generally speaking, presenting information through multimedia is more beneficial compared to single-medium presentations (Levie & Lentz, 1982; Levin, Anglin, & Carney, 1987; Mayer, 2009). Mayer explained this multimedia theory of learning saying, "Learners can better understand an explanation when it is presented in words and pictures than when it is presented in words alone" (Mayer, 2009, p. 3). For example, in one of Mayer's (1989) classic car mechanics studies, he compared the performance of groups that received labeled or unlabeled illustrations and non-illustrated labels of braking systems. Participants that received labeled illustrations performed better on transfer tests and recalled more of the explanative descriptions than participants who received the illustrations without labels. Similar studies have provided further support for multimedia learning theory (Mayer, Bove, Bryman, Mars, & Tapango, 1996; Mayer & Gallini, 1990; Moreno & Mayer, 2002).

The interpretation of findings like these is that the combination of words and images positively impact the cognitive processing of these materials. Researchers argue that multimedia help learners build mental models and focus on important information for the materials to which they are exposed (e.g., Mayer, 1989; Mayer & Anderson, 1991; Mayer, 2009). Continuing this cognitive approach to multimedia learning, researchers also argue that multimedia help learners

reduce cognitive load, arguing in favor of dual-coding theory and the limited-capacity assumption of the auditory and visual channels (e.g., Baddeley, 1986; Chandler and Sweller, 1991; Clark & Paivio, 1991; Paivio, 1974). That is, many who take a cognitive approach to multimedia learning argue that if words and images are combined effectively, they could serve to reduce cognitive load by making processing of information easier for the learner (e.g., Brunken, Plass, & Leutner, 2004; Mayer & Moreno, 2003).

This body of research sets an impressive foundation for understanding the potential benefits of multimedia over single-medium materials. More recently, research in this area has shifted focus to the design of multimedia rather than a comparison to single-medium materials (Ginns, 2005; Mayer, 2011; O'Neil, Mayer, Herl, Niemi, Olin, & Thurman, 2000; Lehman et al., 2007). For example, in several studies examining different materials (booklets with pictures and computer-based animations with on-screen text), researchers (Mayer, Steinhoff, Bower, & Mars, 1995; Moreno & Mayer, 1999) found that groups who received the presentations in which the text was *integrated* outperformed groups who received presentations in which the text was *separated* from the image when learning about lightning. Although materials in these studies were multimedia, the design of the multimedia differed, either having integrated or separated text. This study illustrates an important point about the limitations of multimedia. That is, simply having multimedia is not enough. Rather, researchers acknowledge that the benefits of multimedia may be dependent on variables like design, type of materials, instructional goals, etc. and these ambiguities have led them to call for more research in this area (e.g., Clark & Mayer, 2011; Mayer, 2005a; Ollerenshaw, Aidman, & Kidd, 1997).

Although research on the *design* of multimedia is critical—and is the focus of the last study in this dissertation—it is important to continue comparisons to single-medium materials in

different content areas and with different media because many of the studies comparing text+illustration v. text alone or illustration alone (e.g., Mayer, 1989; Mayer & Anderson, 1991) focused on scientific concepts or workforce learning (e.g., formation of lightning, braking systems, electrical engineering). However, this type of information differs from that which would be communicated in other domains, including psychology. Psychology is an interesting case because much of the information in psychology (and multimedia used to communicate that information) is complex in nature and cannot be explained through a step-by-step illustration or video. Intriguingly, because of the amount and complexity of information included in videos used in psychology, any extraneous information may act as seductive details and lead to extraneous cognitive load, negatively impacting learning (e.g., Garner, Gillingham, & White, 1989; Mayer, 2009; Mayer, Heiser, & Lonn, 2001).

Although it is important to examine how to best design multimedia experiences in content areas like psychology, it is also important to continue examining single media because many instructional situations cannot take advantage of multimedia presentations. Knowing the affordances and challenges of each type of medium specific to the content delivered and learning goals will inform the design and delivery of all media.

Multimedia and Content Area

As discussed above, further research on media comparisons is important because each domain has unique content that informs the content of the multimedia. Because of the vast range of content and learning goals across domains, it is important to understand multimedia potential in the context of the specific domain. Researchers have explored the impact of multimedia in various domains: chemistry, reading, language, mathematics, etc. (e.g., Al-Seghayer, 2001; Atkinson, Mayer, & Merrill, 2005; McKenna, Reinking, & Bradley, 2003). The studies on

multimedia across these domains are varied in their outcomes and the majority of the research focuses on the design of multimedia. Most do not establish first that multimedia is beneficial over single-medium presentations. Those that do make these comparisons show mixed results on learning outcomes depending on the type of multimedia investigated and the content area (Mayer & Anderson, 1991; Al-Seghayer, 2001).

The differences in research across content areas point to an important factor in multimedia research: the impact of multimedia could differ by the content area. This is important to acknowledge, because it suggests it may be beneficial to examine first if particular multimedia materials are beneficial over single-medium materials in a particular domain before examining how to design multimedia within that domain. Additionally, there appears to be a lack of research of the effects of multimedia on learning in the domain of psychology, a content area that often utilizes both single-medium and multimedia materials.

Multimedia and Attitudes

Much of the research done to develop Mayer's theory of multimedia learning relied on cognitive outcomes and theoretical foundations (e.g., dual-coding, cognitive load; Mayer, 1989; Mayer, 2009). In contrast, attitudes, emotions, and motivations were not the focus. Mayer (2009), for example, aligns the role of affect with Kintsch's (1980) *cognitive interest* claim that students will enjoy material they can understand (Mayer, 2009). Although this is certainly a possibility, attitudes and affect related to certain media may also impact understanding.

Research in this area has been divided in terms of the value it places on the role of attitudes (Deimann & Keller, 2006; Mayer, 2009; Weiner, 1990). However, researchers have started to place more emphasis on the role attitudes play in multimedia learning, calling for more attention to work like Moreno's (2007) *Cognitive Affective Theory of Learning with Media*,

which suggests that a learner's motivations and affect may moderate learning outcomes (Deimann & Keller, 2006; Moreno & Mayer, 2007; Plass, Heidig, Hayward, Homer, & Um, 2014; Sun, Tsai, Finger, Chen, & Yeh, 2008). There is some evidence to suggest that positive emotions play a positive role in learning (Efklides, Kourkoulou, Mitsiou, & Ziliaskopoulou, 2006; Isen, Daubman, & Nowicki, 1987). However, this research is still growing in the area of multimedia learning (Moreno, 2007; Plass et al., 2014).

There is also more research needed on the role of attitudes specific to a particular medium. Practically, attitudes could provide a window into learners' motivations to pay attention to and independently access single-medium or multimedia materials provided by instructors. When learners enjoy a particular medium, they may be more likely to pay attention to or access it on their own. In this way, preference for a particular medium could inform the choices educators make. For example, if a learner likes videos more than text-alone, and the content is the same, it would be beneficial for educators to use videos when possible. In contrast, if there is no difference in learners' attitudes toward a particular medium, educators may choose the most convenient medium available, assuming that each medium has equal impact on learning.

Guiding Single-Medium and Multimedia Experiences

Another important factor to consider in multimedia research is the potentially overwhelming nature of multimedia materials. In the case of educational media, additional instructional supports can provide guidance for the learner. These supports can be built into the design of the media, provided by the instructor, or a combination of both. The supports provided in the current studies will be discussed in further detail in subsequent chapters.

One of the primary principles that influenced the instructional supports investigated in the studies reported here was Mayer's *signaling principle*, which suggests providing cues in

multimedia presentations as a way to direct the learner's attention (Mayer, 2005b). In a study using animations, a narrator explained the lift of airplanes (Mautone & Mayer, 2001). In the control group, the narrator explained the process of lift, but did not provide any signals to cue participants to relevant aspects of the process. The experimental group received cues in the form of the narrator listing the steps in the process (Mautone & Mayer, 2001). The experimental group outperformed the control group on transfer tests, suggesting that the cues assisted learners in processing and organizing the information. This implies that signaling is important as an instructional support for this medium.

The three studies discussed herein investigate various guidance strategies, and do so for both single-medium and multimedia presentations. Comparing the impact of the instructional supports for each medium, this research can help inform whether certain supports facilitate learning with certain media better than others. This is important to help guide learners' experiences with all learning materials.

The Current Studies

Psychology often uses both single-medium and multimedia to demonstrate and show applications of psychological concepts. For example, instructors may choose to illustrate the relevance of a concept to students' lives through the use of different media (e.g., news articles, audio-clips, videos). Because of the growing value of media in this domain and their variety, it is important to investigate their impact on learning.

The current studies will be discussed in detail in subsequent chapters. However, they examine 3 key questions:

(1) Does instruction through videos (multimedia) lead to better learning outcomes as compared to text-only or audio-only instruction (single-medium) in the domain of psychology?

(2) Do instructional supports (e.g., advance organizers) lead to better learning outcomes for a particular medium as compared to others in the domain of psychology?

(3) Do learners report more positive attitudes toward particular media in the domain of psychology?

Studies 1 and 2 use multimedia videos commonly used in Introduction to Psychology courses and compare learning outcomes of those videos to single-medium formats. Study 2 also investigates the impact of advance organizers on learning outcomes for each medium. Study 3 investigates a different type of video used in Introduction to Psychology courses to explicitly examine the impact of the timing of instructional supports (i.e., advance organizers and guidance embedded in the video) on learning outcomes. The pragmatic goal of this research is to understand how best to enhance learners' interactions with both single-medium and multimedia environments and to help educators make informed choices about how they design and deliver learning materials. The theoretical goal of this research is to provide new data about the impact of multimedia and their interaction with instructional supports on learning in a rarely investigated domain to understand the domain-general versus domain-specific principles of multimedia learning theory.

CHAPTER 2

THE IMPACT OF MULTIMEDIA AND SINGLE-MEDIUM MATERIALS ON RETENTION (STUDY 1)

Research has advocated for the use of multimedia learning materials, highlighting their impact on learner cognition (e.g., Clark & Mayer, 2011; Levie & Lentz, 1982). For example, researchers argue multimedia materials like animations or illustrations combined with narration provide learners with auditory and visual representations of information, taking advantage of the dual-coding theory of cognition and other cognitive theories like the limited capacity assumption (e.g., Chandler & Sweller, 1991; Clark & Paivio, 1991; Moreno & Mayer, 2002). The suggestion is that the learning benefits of multimedia materials largely overshadow those of single-medium materials, like text-only representations when multimedia presentations successfully take into account how learners' minds work (Clark & Mayer, 2011; Levie & Lentz, 1982; Levin et al., 1987).

Substantial empirical evidence points to the benefits of multimedia as compared to single-medium materials and the majority of these comparisons were conducted in the previous century (Mayer, 1989; Mayer & Anderson, 1991; Mayer et al., 1996; Mayer & Gallini, 1990), leaving the implication that the case is closed and multimedia presentations are more beneficial than presentations in a single medium. More recently, the focus in multimedia research has been on design of multimedia materials (Clark & Mayer, 2011; Mayer & Johnson, 2008; Schmidt-Weigand, Kohnert, & Glowalla, 2010). In part, the reason for this shift is that materials that qualify as multimedia are diverse and vast. For example, a picture in a textbook with corresponding text is considered multimedia and so is a video with sound. Technology has also changed what is possible for the *design* of multimedia. Technology advancements have allowed for multimedia to extend beyond static images or simple animations (e.g., Levie & Lentz, 1982;

Mayer, 1989), opening a rich area of research in multimedia design. Technology has also made it possible to utilize more multimedia in many content areas, adding to the variability of multimedia. For example, in psychology, the increasing ease and accessibility of videos has made it possible to develop rich portrayals of psychological concepts and research through interviews with researchers, TED talks, demonstrations, etc.—all of which vary from each other. The variability brought about by technological advancements certainly warrants more research on the design and delivery of multimedia in education. It is also important to return to the classic comparisons of multimedia over single-medium materials, because the multimedia of today look quite different than those used in the seminal research and may present new strengths and challenges.

Video as Multimedia

The current study focuses on video as multimedia. The popularity and accessibility of arenas like YouTube have made video a favored medium to share information about concepts both in and outside the classroom. In psychology, videos are common multimedia materials used to expose students to research and applications of concepts to real-world issues. Videos are valuable because they allow vivid portrayals of what may otherwise be static textbook material.

In addition to key concepts, many psychology videos also contain contextual information. These types of videos may look very different than a video describing procedural information in other domains. For example, in nursing, a video might show the step-by-step *procedure* of drawing blood. Or, in environmental science, *the steps* by which lightning forms may be described through a video. In psychology, it is less likely than in other domains for procedural information to be demonstrated in instructional videos. In psychology, videos often anchor concepts in "real-world" examples.

Although there has been research on multimedia that is comparable to video-like animations (e.g., Betrancourt, 2005; Hegarty, 2004; Mayer, Hegarty, Mayer, & Campbell, 2005), little of the research on multimedia has focused on video as a type of medium, and even less has compared video and the same content in the video presented through single-medium materials (Al-Seghayer, 2001; Hanley, Herron, & Cole, 1995). For example, in an early study by Hanley, Herron, and Cole (1995), comprehension of foreign language videos was tested. Different advance organizers for the videos were manipulated to be in single-medium or multimedia formats. That is, in one condition, teachers read six sentences summarizing the video aloud. In the other condition, a picture was shown along with each of the six sentences the teacher read. They found significant positive benefits for the comprehension of the videos when advance organizers were multimedia in nature. Another study with video focused more directly on comparing video to other single-medium. A study by Al-Seghayer (2001) found a video-with-text group outperformed groups that were taught through static pictures with text or text alone.

These studies represent important steps toward understanding how to facilitate comprehension of videos and the potential benefits of the medium. However, research in this area is limited and the diversity of videos across domains is vast (e.g., Lawson, Bodle, Houlette, & Haubner, 2006; van Es & Sherin, 2010). Content can be produced and edited in significantly different ways, making the potential design of videos endless. Because video is such a varied and dynamic category, more research needs to be done to target its potential affordances and challenges.

Preference for Media

Research has emphasized that multimedia may also lead to increased liking of lessons presented over single-media presentations (e.g., Moreno, 2007; Plass et al., 2014). This is of

particular interest in multimedia versus single-medium comparisons because learners' attitudes could play important roles in deciding which media educators choose. Practically, if learners like a particular medium over another, and there are no significant differences in learning outcomes, educators can choose the medium that learners like the best. These comparisons are also important to make across different content areas because the effect of liking interacting with one medium or another may vary across domains; in addition, the relation between liking and learning from that medium may vary across domains. For these reasons, it is worthwhile to examine the role of attitudes and learning from different media in the domain of psychology.

Assessing Learning

Another variable that may mediate the effects of a single-medium versus multimedia presentations is the cognitive level of the question asked in learning outcome measures. Research on multimedia learning has largely relied on recall tasks (e.g., write down everything remembered about the process of lightning formation) or transfer tests (e.g., applying knowledge to new problems) to assess learning (e.g., Al-Seghayer, 2001; Mayer, 2005a; Mayer & Gallini, 1990). However, there are mixed results on these learning outcomes, depending on the type of media investigated and the subject area, as illustrated by the two examples given here.

Mayer and Anderson (1991) compared groups that received either narration with animation (simultaneous presentation), narration before animation (words-before-pictures), narration without animation, or no training (control). The target of the lesson was on the mechanisms of a bicycle tire pump. Mayer and Anderson measured learning in terms of retention tests and transfer tests. They found no significant difference on retention tasks, but those in the narration-with-animation group performed significantly better than the other groups on transfer tests. In contrast to Mayer and Anderson (1991), Al-Seghayer (2001) found

significant differences on retention measures for the video-with-text group in his study. Although the retention measures were similar in both studies, the differences in learning outcomes may have been due to the different materials and content areas that were investigated. Mayer and Anderson's study focused on the mechanisms of a bicycle tire pump and Al-Seghayer focused on a foreign language.

These studies highlight the importance of further examining the impact of single-medium and multimedia learning environments on different learning outcomes and in different content areas like psychology. There is not enough information about when multimedia leads to better retention over single-medium materials or how this differs depending on content domain. And, although it seems there are benefits of multimedia for transfer tasks, it is unclear whether those benefits hold for other domains or how to support learners' experiences so that transfer does not suffer in single-medium environments.

Current Study

Although there is an early body of research comparing multimedia and single-medium, the current study investigates these differences further for at least three reasons. First, because much of the prior work in this area has targeted procedural aspects of scientific concepts, the current study extends this work to target psychology. This domain is particularly important because media are commonly used in this domain to illustrate complex concepts rather than procedures, and are increasingly provided as supplemental materials for textbooks.

Second, little of the research on multimedia has focused on comparing video as multimedia to other single-medium materials (e.g., Al-Seghayer, 2001; Hanley et al., 1995). Investigating video will contribute to the literature in significant ways, especially in psychology, because many of the videos currently in use feature a researcher describing findings. These

videos lend themselves well to the current investigation because the concepts are not illustrated in the video, but just discussed. Furthermore, presenting the same content in multimedia format (video+audio) and single-medium formats (audio-only, text-only) may help isolate the impact of specific media for learning. In addition, many videos used in psychology are unlike the animations and videos used in prior studies (Al-Seghayer, 2001; Clark & Mayer, 2011; Hegarty, Kriz, & Cate, 2003; Tversky, Morrison, & Betrancourt, 2002). It is important to acknowledge these differences and to examine the affordances and challenges of videos used in psychology.

Third, and finally, this study examines attitudes toward videos as compared to the same information presented in single-medium formats. Having the exact same material presented in three different formats and then simply asking how much learners liked each medium can provide a window into attitudes toward each media, because the only thing that differed was the medium. Although the current study does not intentionally manipulate the design of the media to elicit positive attitudes toward each medium or a particular multimedia design, it does acknowledge the potential importance of attitudes in informing media choices made by psychology educators.

The goal of this research is to identify affordances and challenges of learning materials that instructors frequently use in their classrooms. It would be valuable to know if students will have trouble learning from different media or if the multimedia presentation is not particularly beneficial for the type of materials and learning outcomes being used in this particular domain.

Method

Participants

This study consists of data from 146 participants. There were 112 females and 34 males in this study. The average age of participants was 20 years old. Participants were enrolled in educational psychology and psychology courses at a large university in the Midwest. The

average number of psychology classes taken in high school was .64 (*SD*=.62). The average number of psychology classes taken in college was 2.06 (*SD*=2.06). Participants received research credit for participating in this study.

Materials

Videos and modified media derived from videos. This study used videos from an Introduction to Psychology course. These videos serve as supplemental materials for instructors to use online or in the classroom. The videos apply psychology concepts through interviews with researchers who explained their research and findings. In addition to the video+audio format, these videos were modified to be in audio-only format and text-only format (i.e., transcripts).

Media and their delivery. To deliver the three media—videos, transcripts and audio clips—this study used the quiz portion of an online learning management system (LMS) with which participants were familiar, because it was widely used at the university. All participants accessed this LMS on a desktop Mac computer in the lab (a large room with 3 desks, each equipped with a computer).

Surveys. In addition to completing the quizzes, participants completed a short survey of biographical information (See Appendix A) prior to the study. Participants also answered a survey about their attitudes toward the videos, transcripts, and audio clips after completing the study (See Appendix A).

Design

This was a pretest-intervention-posttest within-subject factorial design. All participants were tested on the same concepts. All participants were exposed to all media (videos, transcripts, and audio clips). However, participants received different combinations of concept-medium (e.g.,

one participant would be exposed to the hypnosis content by viewing a video, while another participant would be exposed to the same content by listening to an audio version).

Procedure. Each participant answered 27 questions on the LMS. The pretest consisted of 9 questions, the intervention was 9 questions, and the posttest was 9 questions. Each participant was tested individually, and a maximum of 3 participants were in the lab at one time. Every participant used headphones during the study. All questions tested participants' foundational knowledge of the concepts.

Pretest. The pretest questions (See Appendix A) were designed to measure participants' prior knowledge of concepts they would learn about during the intervention. Pretest questions were randomized.

Intervention. The next 9 questions were embedded in the intervention phase and were presented in a format that mimicked a typical teaching situation. In particular, participants were exposed to a discussion of research (in one of the 3 media: video, audio, or text) about a concept in psychology and then answered a question about that concept. For example, a participant watched a video about research on the link between emotions and memory, and then answered a question about the relation between emotions and memory. Participants answered questions in this manner for 9 concepts. The questions tested recall of information that was explicitly given in the video. It is also important to note that each discussion of research was presented without the question visible (See Appendix A for examples). Participants were also instructed to view the video, read the transcript, or listen to the audio only once.

Posttest. Following the intervention, each participant took a 9-question posttest. Posttest questions were randomized. The posttest questions were modified versions of the pretest and were nearly identical to the pretest questions.

Surveys. Before beginning the study, participants completed a short survey of biographical information. The goal of the biographical survey was to have access to potential important variables (e.g., age, gender, etc.) that may be related to learning outcomes. After participants completed the study, they were given attitude surveys. The goal of the attitude survey was to examine participants' attitudes toward the videos, transcripts, and audio-clips that may provide insight into the participants' engagement with those media.

Results

One participant did not complete the study and was removed from all analyses, leaving 146 participants for analyses.

Descriptive Statistics

The mean number of correct responses on the pretest was 6.41 (*SD*=1.27). The mean number of correct responses during the intervention phase was 7.94 (*SD*=1.24). The mean number of correct responses on the posttest was 7.77 (*SD*=1.26).

Figure 2.1 shows the distribution of correct responses at pretest, intervention, and posttest, based on the medium with which participants were taught. Figure 2.2, based on the same data, shows the distribution of performance at pretest, intervention, and posttest for each concept.

Analyses of Pre- and Posttest Performance

A mixed-model analysis with a hierarchical structure was utilized to account for the fact that questions were nested in participant, because the characteristics of each participant could have impacted their performance on each question. Therefore the nested nature of the data was taken into account by considering the random effects of participant, but the nature of the questions was the focus (e.g., concept, performance, etc). Questions were level 1 and participant was level 2 for all analyses.

One of the primary areas of interest was whether questions were more likely to be correct at posttest if the concepts were taught through a particular medium during the intervention phase. To investigate the impact of medium, the model included **pretest score**, **medium**, **psychological concept**, **intervention score** and the **interaction between intervention and pretest** as predictors, with **posttest as the outcome** variable. Analyses revealed no significant effect of medium. However, pretest score, psychological concept, and intervention score were significant predictors of posttest score ($F(1, 1155)=14.07$ $p<.01$; $F(8, 1155)=8.73$, $p<.0001$; $F(1, 1155)=49.86$, $p<.0001$ respectively). The interaction of pretest and intervention was also significant ($F(1, 1155)=8.29$, $p<.01$). In other words, getting questions correct at pretest significantly increased one's chances of getting questions correct at posttest. Furthermore, getting questions correct at pretest *and* intervention significantly increased one's chances of getting questions correct at posttest.

Because both the concept and performance at pretest accounted for significant amounts of the variance in posttest performance, follow-up analyses eliminated concepts on which participants' average pretest scores were 80% or better (i.e., were close to or at ceiling before receiving the intervention). Thus, 5 concepts were removed and the data reanalyzed with the remaining 4 concepts: hypnosis, oxytocin, amygdala, and synesthesia. The **interaction of concept and medium** was also added to the model to explore whether certain concepts were more difficult to learn in a certain medium. All variables that were significant in prior analyses remained significant, including concept ($F(3, 430)=3.55$, $p<.05$). Medium was not significant ($F(2, 426)=.18$, $p=.83$). The interaction of concept and medium also was not significant ($F(6, 426)=.92$, $p=.48$).

Analyses of Performance During the Intervention Phase

Another point of interest was whether performance on questions given during the intervention phase would differ, depending on medium. It may have been the case that the effects of media were only seen when questions were asked immediately after seeing the video, reading the transcript, or listening to the audio clip. Analyses using **pretest, medium,** and **concept** as predictors with **intervention as the outcome** revealed a significant effect of concept ($F(8, 1157)=3.30$, $p<.01$). Medium and pretest were not significant ($F(2, 1157)=1.53$, $p=.22$; $F(1, 1157)=.99$, $p=.32$).

Concepts on which participants' average pretest scores were 80% correct or better were again removed, revealing the same results. The amygdala and hypnosis questions were the most difficult for participants and the synesthesia question was the least difficult.

Attitudes Toward Media

A rating of 1 indicated strong dislike of the medium in question, and a rating of 5 indicated a strong preference for the medium in question. The mean of the first question on the attitude survey (liking of video questions) was 4.18 ($SD=.90$). The mean of the second (liking of audio questions) was 3.5 ($SD=.97$), and the mean of the third (liking of transcript questions) was 3.01 ($SD=1.19$). There was a significant main effect of medium on participants' ratings ($F(2, 290)=53.82$, $p<.0001$). Contrasts further revealed that ratings for each medium varied significantly from each other with video questions as participants' favorite medium and transcripts as participants' least favorite medium (video v. text; $F(1, 290)=106.5$, $p<.001$).

Given the participants' preference for receiving information from video (i.e., audio+ video), it was important to follow up and investigate the relationship between the ratings of each medium and performance. For example, it would be interesting if participants performed poorly on a particular medium, but still had positive attitudes toward that medium.

Because the medium varied only during intervention, analyses for attitude survey questions focused on performance at the intervention only. The best fitting model included **concept, medium, attitude survey questions** and the **interaction of attitude survey questions and medium** as predictors of **performance at intervention**. Analyses revealed a significant effect of concept ($F(8, 1152)=3.71$, $p<.01$) and the interaction of medium (audio) and how much the participant liked the audio questions ($F(2, 1152)=4.4$, $p<.05$). In particular, higher ratings of the audio medium predicted better performance on audio questions during the intervention. No other predictors were significant.

Items at or close to ceiling at pretest were again removed, revealing the same significant interaction between ratings of audio and performance on audio questions at intervention ($F(2, 427)=4.74$, $p<.05$). In addition, there was a significant interaction between participants' perceptions of the transcript medium with both transcript and audio questions ($F(2, 427)=5.22$, $p<.05$; $F(2, 427)=4.48$, $p<.05$ respectively). Higher ratings of the transcript medium predicted better performance on both audio and text questions at intervention.

Discussion

Medium Does Not Matter

Analyses suggest that although prior knowledge and performance on questions embedded in the intervention predicted answering questions correctly on the posttest, the medium used to teach a concept during the intervention phase did not add significantly to predicting performance at posttest or at intervention. This finding is consistent with many of the early comparisons of single- versus multimedia (e.g., Peeck, 1974; Rusted & Coltheart, 1979), which found that multimedia (text+illustration) was rarely superior to single-medium comparisons (text-only) on

retention tasks, particularly when the information to be recalled was in the text but not reflected through the illustrations.

One of the characteristics of psychology videos like those used in Study 1 is that the images do not necessarily convey any additional information about the content beyond what is presented in the audio track. For example, an image of a researcher in his lab may be an interesting and engaging visual image, but the image of the researcher in the lab does not provide visual support for understanding the content beyond the information provided in the narration.

Another reason there may not have been significant learning differences across conditions was because the outcome measures in Study 1 only required learners to recall information explicitly communicated in the narration or text. When students are asked to recall such straightforward information, it may not make a difference in which modality the information is presented. This has practical implications. For psychology instructors, who use similar materials in their classrooms or online learning, if, for example, there is only an audio clip available on a topic (e.g., NPR clip) or students are looking down while watching a video, learning will not be negatively impacted provided the learning goal is simply for students to recall what was said or written.

The Importance of Prior Knowledge and Performance at Intervention

The intervention phase was designed to resemble an authentic teaching situation, as instructors typically provide information and then ask questions about that information. For each of the three types of media presentations, the students received information about psychological concepts and then received a question about that concept. Analyses revealed an additive effect on performance at posttest of getting a question correct at pretest plus getting a question correct immediately after learning about that concept during the intervention phase. That is, both prior

knowledge and success during the intervention contributed to answering questions correctly on the posttest. This is not particularly surprising, but it does suggest that educators should take into account students' prior knowledge into account when teaching through any medium. Additionally, because the posttest occurred after watching, listening, or reading and answering 9 questions, the finding suggests that if students have prior knowledge *and* are successfully understanding the media, this could benefit their learning as well. The exposure to the media may have reinforced prior knowledge and boosted chances of success during the posttest. These interpretations are made cautiously, because participants answered the posttest questions directly after the intervention. Further research, with delayed posttests, would provide valuable information about effects on long-term retention.

Preference for the Medium of Instruction

Although the medium in which the intervention was presented did not impact differences in performance either during or after the intervention, participants showed significant preference for interacting with the video questions over the audio and transcript questions. Transcript questions were participants' least favorite. These findings have practical implications for instructors. That is, if only the learning goal is taken into account and that learning goal is basic understanding of the concepts, students can perform successfully regardless of the medium. However, if students like videos more than audio or text presentations, this suggests when instructors have the option, they may want to incorporate videos into their courses to encourage student enjoyment of the content. Although it was not the case here, positive emotions can contribute positively to learning (e.g., Efklides et al., 2006). Furthermore, catering to learners' interests could help increase motivation to learn the content and increase the tendency for

students to seek out or access materials they like more when engaging in online learning or other independent learning scenarios (e.g., Moreno, 2007; Venkatesh, Morris, Davis, & Davis, 2003).

There was also an interaction between participants' liking of audio questions and performance during the intervention on audio questions. When participants gave higher ratings of audio questions, they were more likely to answer those questions correctly during the intervention phase. Because participants were not asked to judge how well they did on the questions according to the media they were presented, it is difficult to interpret this finding in relation to performance. However, it is interesting that audio was the only medium to have this effect. Judgments of learning were not the focus of this study. However, this would be an interesting relationship for future research to examine.

Implications for Teaching

Taken together, the findings of Study 1 contribute to knowledge about the impact of single-medium and multimedia materials for learning in Introduction to Psychology courses. Although videos are popular and fairly easy to access, it is promising that when videos are not available, at least videos like those used in this study, text materials or audio-only materials contribute to learning outcomes equally as well. In addition, participants responded positively to the psychology videos used in this study. Although all the media contained the same content, participants liked the videos more. In light of the finding that medium did not significantly impact learning, the preference for video supports the idea that psychology instructors can accommodate learner interests in their selection of media, without concerns that learning will suffer.

Study 2 continues the investigation of the impact that single-medium and multimedia have on psychology learning and student perceptions. The study extends Study 1 to look at

participants' abilities to *apply* the information communicated through the various media, as Study 1 only focused on retention. Study 2 also looks more in depth at participants' perceptions of media. For example, the study explores participants' perceptions of how well they performed on transcript, audio, and video questions in addition to how much they liked each medium. Lastly, Study 2 incorporates instructional supports to better understand the relationship between the instructional support and media and their impact on learning. Together, Studies 1 and 2 provide practical information for psychology instructors about considerations for using both single and multimedia in their teaching to facilitate learning and to accommodate learners' preferences.

Figure 2.1: Performance by medium

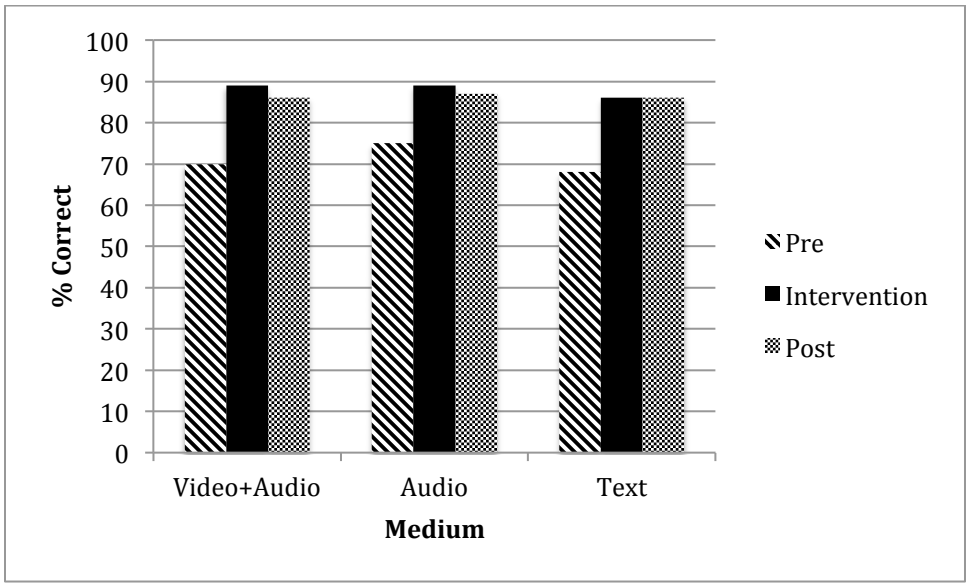
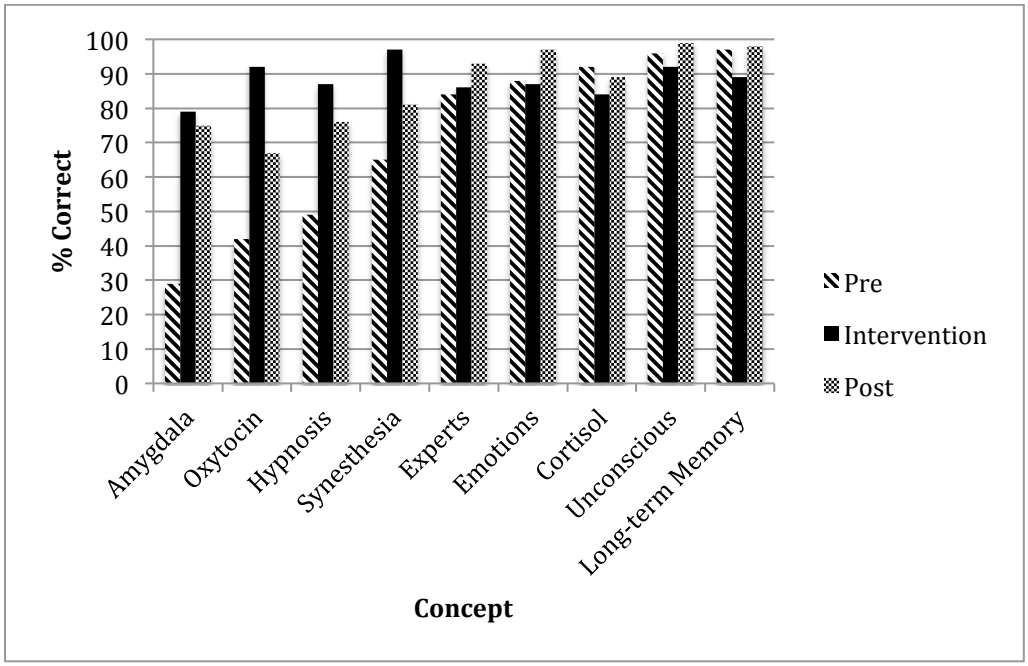


Figure 2.2: Performance by concept



CHAPTER 3

THE IMPACT OF MULTIMEDIA AND SINGLE-MEDIUM MATERIALS ON APPLICATION: THE ROLE OF INSTRUCTIONAL SUPPORTS (STUDY 2)

Technology advancements have allowed 21st century instructors and learners to access multimedia on many topics. The options are seemingly endless. However, the convenience and vastness of available multimedia also brings challenges when the goal is learning. Learning is effortful, even for technology-savvy learners with many resources at their fingertips. When multimedia is used for educational purposes, the needs of the learner must be prioritized over the accessibility and appeal of multimedia. Research that investigates factors that impact learning from multimedia and how to support learners will help educators exploit the strengths of all media while accommodating the needs of learners.

As we learned from the previous study, the type of media may not impact learning when the goal is retention. It is possible, however, that the medium in which information is presented may affect learning when students are asked to answer questions that ask more than to remember and, instead, to engage in higher-level thinking. Much of the research comparing the effects of multimedia to single-medium materials on higher-level thinking skills has focused on transfer, often demonstrating that multimedia is more effective than single-medium materials at facilitating transfer skills (e.g., Mayer, 2011). This body of research suggests the effectiveness of different media may depend on the instructional goal.

It is also important for current media comparisons to investigate differences with both lower (e.g., retention) and higher-level (e.g., application) instructional goals in different content areas, because content areas are unique. Psychology instructors often use educational media to facilitate students' abilities to apply content from the course, going beyond simple retention.

Therefore, it is important for research comparing multimedia and single-medium materials in psychology to examine their impact on students' application skills, which are important skills in learning content in Introductory Psychology.

When instructional goals are more challenging than simply retaining the material to be taught, support may also be critical because the more when instructors want more from their students, they may have to help them get there. This also seems to be what typically happens: When instructors are available in learning situations, they typically try to offer support to their students. The question is open of how to offer supports in ways that best helps learners. Within the context of multimedia research, there is also a question of whether specific supports are more beneficial with certain media than with others. In Introduction to Psychology, instructors have many media available to them that help students apply concepts to real-world contexts (e.g., research articles, videos, audio clips, etc.). Each available option may present unique affordances and unique challenges to learners and therefore require unique instructional supports. Learning more about the impact of different types of instructional supports on learning from different sorts of media will help instructors make the best choices for their students.

There are many ways to support learning but this study will focus on the combination of advance organizers and note-taking. These instructional supports are the focus because researchers have identified them as beneficial in various learning contexts (e.g., Ambard & Ambard, 2012; Corkill, 1992; Kobayashi, 2007). However, the research on advance organizers and note-taking is divided in terms of *when* these supports are beneficial (e.g., Bohay, Blakely, Tamplin, & Radvansky, 2011; Gurlitt et al., 2012; Lin & Bigenho, 2011; Ponce & Mayer, 2014). The content area and type of media are some of the factors that may impact the effectiveness of note-taking and advance organizers. Instructional goals differ across content that may impact the

amount and type of support needed by learners. Additionally, each type of media has its own affordances and challenges that may need to be supplemented in different ways through different instructional supports. This study contributes to this body of work by investigating the impact of these instructional supports using psychology videos presented in single and multimedia formats.

Instructional Supports

Advance organizers. Advance organizers generally refer to instructional units presented prior to the main instruction (Gurlitt, Dummel, Schuster, & Nuckles, 2012; Lin & Chen, 2007). Although the classic definition of advance organizers requires that the units are provided at a higher level of abstraction than the content of the main instruction (Ausubel, 1960), research on advance organizers has structured advance organizers in a variety of ways (e.g., Chung, 2002; Gurlitt & Renkl, 2010; Gurlitt et al., 2012). Expanding what qualifies as an advance organizer has been beneficial in the context of multimedia research given the growth in the nature and variety of media. The structure of advance organizers may need to be tailored to accommodate changes in media, and research on the impact of advance organizers across different media will help inform potential ways to structure these instructional supports.

Research has identified key factors advance organizers should consider, no matter their structure. Advance organizers should introduce the main points of the instruction, cue attention to relevant concepts, and provide a preview of the new information (Ausubel, 1978; de Jong, 2011; Schmidt, De Volder, De Grave, Moust, & Patel, 1989). Although this research on advance organizers has not been conducted with psychology videos specifically, it does highlight the importance of providing learners with supports that cue them to relevant information to guide their interactions with multimedia. It is also well established that more research is needed to identify what types of advance organizers work best, under which circumstances (Barnes &

Clawson, 1975; Gurlitt et al., 2012; Stull & Mayer, 2007). More research with videos is particularly beneficial as there is not much research in this area and it is a popular multimedia tool (e.g., Herron, York, Cole, & Linden, 1998). Additionally, comparing the effectiveness of advance organizers with videos v. single-medium materials that communicate the exact same content could help isolate the differences in their effectiveness depending on medium of instruction.

Note-taking. Research has also identified note-taking as a helpful learning strategy, particularly when that note-taking is guided through supports like outlines, PowerPoints, or note-matrices that have some of the key information already provided (Kobayashi, 2007; Lazarus, 1991; Ryan, 2001; Stefanou, Hoffman, & Vielee, 2008). Note-taking may help learners keep track of key concepts and unpack their cognitive load, but research has also pointed out that providing learners with some structure for their note-taking may be important for the note-taking to be effective (e.g., Kobayashi, 2007; Ponce & Mayer, 2014; Stefanou et al., 2008).

Note-taking, especially in combination with advance organizers that point out key concepts, may be particularly beneficial for psychology videos because these videos often contain a lot of information for learners to process and note-taking and advance organizers may support learners in processing this information. To help learners, advance organizers could help cue learners to relevant information, and note-taking provides the opportunity to unload that information so it does not need to be kept in working memory.

In addition, these instructional supports may help learning from single-medium presentations as well. For example, providing support through advance organizers and note-taking may facilitate learning from educational media when information is presented in a text-only format, because learners do not have the cues to relevant information that may be provided

by the images in the video. In any case, knowledge about the effectiveness of these instructional supports would contribute to the effective use of media in psychology education.

Current Study

The current study extends Study 1 to investigate the impact of psychology videos on outcome measures that test application skills, which are considered higher level than retention skills, which were tested in Study 1. The videos are again compared to single-medium versions that communicate the same content to examine potential learning differences across media.

In addition, this study investigates the impact of advance organizers combined with note-taking on learning outcomes. Differences between a control group without this instructional support and an experimental support with this support are explored. The impact of this support across media is also investigated.

Finally, this study continues the exploration of the potential role of participants' attitudes toward media play in learning outcomes.

Investigating how to guide learners' experiences with media used in psychology instruction is critical, because learners frequently may be exposed to media like the videos used in Study 1 and the current study. Exposure alone does not ensure students will know what information is relevant. The goal of this study is to contribute to knowledge about how to guide learning experiences of information typically presented in introductory psychology with several types of media.

Method

Participants

This study consists of data from 124 participants (34 males and 90 females). The average age of participants was 21 years old. Participants were enrolled in educational psychology and psychology courses at a large university in the Midwest. The average number of psychology

classes taken in high school was .6 (*SD*=.6). The average number of psychology classes taken in college was 2.3 (*SD*=2.32). Participants received research credit for participating in this study.

Design

The design of this study was similar to that of Study 1, with a few important distinctions. As in Study 1, this is a pretest-intervention-posttest mixed factorial design and all participants were tested on the same concepts and were exposed to all media. Distinct from Study 1, some participants were exposed to an "advance organizer" condition. Participants were assigned to one of two groups: (1) control or (2) advance organizer. Both groups are discussed further in the Procedure.

Procedure. The procedure for this study was similar to Study 1. Each participant answered 27 questions on the LMS. The pretest consisted of 9 questions, the intervention was 9 questions, and the posttest was 9 questions. Each participant was tested individually, and a maximum of 3 participants were in the lab at one time. Every participant used headphones during the study.

Pretest. The pretest questions (See Appendix B) were designed to measure participants' prior knowledge of concepts they would learn about during the intervention. Pretest questions were randomized.

Intervention. The next 9 questions were embedded in the intervention phase and were presented in a format that mimicked a typical teaching situation. In particular, participants were exposed to a discussion of research (in one of the 3 media: video, audio, or text) about a concept in psychology and then answered a question about that concept. For example, a participant watched a video about research on the link between emotions and memory, and then answered a question that required participants to apply their knowledge of this concept to a scenario (See

Appendix B for examples). Participants answered questions in this manner for 9 concepts. It is important to note that each discussion of research was presented without the question visible (See Appendix B). Participants were also instructed to view the video, read the transcript, or listen to the audio only once.

Control group. Participants in the control group followed the same procedure as those in Study 1, but questions required participants to apply their knowledge of the concepts. This was to investigate whether there were media effects when the instructional goals were at a higher-level as compared to Study 1.

Advance-organizer group. Participants in this group saw a short advance-organizer video with audio (15-20 sec) prior to each discussion of research. The video did three things. First, it encouraged participants to take notes (e.g., "Take notes as you watch the following video.") Second, the video directed attention to key concepts to help guide the viewer's attention. Three key terms were always mentioned (e.g., "Pay attention to key terms like novices, experts, and practice.") Third, the video encouraged participants to think about application (e.g., "Also think about how the findings of the study might apply to other situations.") The goal was to help participants focus on important information. After viewing the advance-organizer video, participants indicated they were ready to move to the discussion of research expressed through a video, audio clip, or transcript.

Note-taking. Participants in the advance-organizer condition had the opportunity to take notes on the discussion of research during the intervention phase. Prior to starting the intervention, participants were provided with 9 sheets of paper and told, "The next part of this study will prompt you. Let me know if you have any questions." If participants asked for further clarification, they were told, "You will be given instructions once you push play [on the

advance-organizer video]." After each video, audio clip, and transcript, participants were told to put away their notes in a folder beside them. No participant had access to his or her notes when answering questions.

Posttest. Following the intervention, each participant took a 9-question posttest. Posttest questions were randomized. The posttest questions were modified versions of the pretest and nearly identical to the pretest questions.

Surveys. Before beginning the study, participants completed a short survey of biographical information. After participants completed the study, they were given attitude surveys.

Materials

Media and their delivery. This study used the same videos, transcripts, and audio clips used in Study 1. To deliver the 3 media—videos, transcripts, and audio clips— this study used the same quiz portion of the same learning management system (LMS) used in Study 1. All participants were familiar with the LMS, because it was widely used at the university. All participants accessed the LMS on a desktop Mac computer in the lab (a large room with 3 desks, each equipped with a computer).

Notes. Participants in the advance-organizer condition were provided with 9 sheets of paper, each of which corresponded to a question they would be asked during the intervention. The top of each paper simply denoted the question number (e.g., "Question One").

Surveys. The goal of the biographical survey was to have access to potential important variables (e.g., age, gender, etc.) that may be related to learning outcomes. The goal of the attitude survey was to examine participants' attitudes toward the videos, transcripts, and audio-clips that may provide insight into the participants' engagement with those media. Distinct from

Study 1, additional items were added to the attitude surveys to better examine attitudes toward the media and technology in general.

Results

Seven participants did not complete the study and were removed from all analyses, leaving 124 participants for analyses. The control group had 63 participants. The advance-organizer group had 61 participants.

Descriptive Statistics

The mean number of correct responses on the pretest was 5.05 (*SD*=1.63), and there was no significant difference between the control group's and advance-organizer group's pretest scores, $t(60)=.157$, $p=.88$.

The mean number of correct responses during the intervention phase was 7.36 (*SD*=1.41). The mean number of correct responses on the posttest was 7.26 (*SD*=1.56).

Figures 3.1 (control) and 3.2 (advance-organizer group) show the distribution of performance at pretest, intervention, and posttest based on the medium in which the material was taught. Figures 3.3 (control) and 3.4 (advance-organizer group) show the distribution of performance at pretest, intervention, and posttest based for each of the instructed concepts.

Analyses of Pre- and Posttest Performance

A mixed-model analysis with a hierarchical structure was utilized to account for the fact that questions were nested in participant because the characteristics of each participant could have impacted their performance on each question. Therefore the nested nature of the data was taken into account by considering the random effects of participant, but the nature of the questions was the focus (e.g., concept, performance, etc). Questions were level 1 and participant was level 2 for all analyses.

One of the primary areas of interest was whether questions were more likely to be correct at posttest if the concepts were taught through a particular medium during the intervention phase. To investigate the impact of medium, the model included **pretest score**, **intervention score**, **medium** used to present the research, **psychological concept**, **condition** (control or advance organizer), and the **interaction between pretest and intervention** as predictors and **posttest as the outcome** variable. This analysis revealed significant effects of pretest ($F(1, 979)=28.18$, $p<.0001$), concept ($F(8, 979)=2.92$, $p<.01$), and intervention ($F(1, 979)=34.94$, $p<.0001$). Medium and condition were not significant ($F(2, 979)=1.22$, $p=.30$; $F(1, 979)=2.39$, $p=.12$ respectively) nor was the interaction between pretest and intervention ($F(1, 979)=.49$, $p=.48$).

Because both the concept and performance at pretest accounted for significant amounts of variance in posttest performance, concepts on which participants' average pretest scores were 80% or better were eliminated for follow-up analyses. Thus, 3 concepts were removed and the data were reanalyzed with the remaining 6 concepts: amygdala, cortisol, emotion, hypnosis, oxytocin, and synesthesia. The **interaction of concept and medium** was also added to the model to investigate whether certain concepts were more difficult to learn in a certain medium. Medium, concept, and condition were not significant. The interaction of concept and medium was not significant ($F(10, 602)=.66$, $p=.76$) nor was the interaction of pretest and intervention ($F(1, 602)=.00$, $p=.95$). Pretest and intervention remained significant ($F(1, 602)=21.26$, $p<.0001$; $F(1, 602)=38.40$, $p<.0001$, respectively).

Analyses of Performance During the Intervention Phase

Another point of interest was whether performance on questions given during the intervention phase would differ, depending on medium. Concepts on which participants' average pretest scores were 80% correct or better were removed as they were for prior analyses. The

pretest score, psychological concept, medium, and condition were entered as predictors of **intervention performance**. Pretest and concept were significant ($F(1, 612)=12.43$, $p<.01$; $F(5, 612)=18.71$, $p<.0001$ respectively), but analyses revealed no significant effects for medium or condition ($F(2, 612)=1.92$, $p=.15$; $F(1, 612)=.65$, $p=.42$, respectively).

The **interaction of condition and medium** was then added to the model to investigate whether performance at intervention depended on the condition to which one was assigned and the medium through which one learned the concepts. As was the case before this interaction was added to the model, there were significant main effects for pretest and concept ($F(1, 610) =12.90$, $p<.001$; $F(5, 610)=18.79$, $p<.0001$ respectively), but not for medium or condition ($F(2, 610)=1.83$, $p=.16$; $F(1, 610)=.47$, $p=.49$, respectively). However, the interaction of condition and medium was significant ($F(2, 610) =5.11$, $p<.01$). In particular, the advance organizers were significantly more beneficial for audio and text questions than for video questions. In other words, if participants were taught through audio or text *and* did not have advance organizers, they performed significantly worse at the intervention than those who had advance organizers for those media. This suggests advance organizers were particularly helpful for learning with audio and text, but not for learning with video. This finding will be examined further in the Discussion.

Note-taking and Learning

Because only those in the advance-organizer group were allowed to take notes, analyses for note-taking focused only on the advance-organizer group. Concepts on which participants' average pretest scores were 80% or better were again removed for these analyses. The goal of these analyses was to examine whether taking notes helped those in the advance-organizer group. There were no significant effects of note-taking for the advance organizer group. In particular, taking notes did not predict performance at posttest or at intervention ($F(1, 296)=1.91$, $p=.17$;

$F(1, 296)=.00$, $p=.96$, respectively). Note-taking also was not effective for any particular medium for posttest or intervention performance ($F(2, 290)=.01$, $p=.99$; $F(2, 290)=.35$, $p=.7$, respectively). The notes also were not substantive enough to warrant qualitative analyses.

Attitudes Toward Media

There were 19 questions on the affective survey that investigated attitudes toward computers, motivation to learn psychology, attitudes toward media, and ease of learning psychology. All questions referred to participants' experiences with the study and media, except the 4 items about attitudes toward computers (See Appendix B). Items were adapted from prior research assessing similar attitudes toward technology and learning psychology concepts through multimedia (Moreno, 2007; Venkatesh et al., 2003).

First, the 3 questions regarding liking of each of the media were compared. These questions were the same as those on the attitude survey in Study 1. A rating of 1 indicated strong dislike of the medium in question, and a rating of 5 indicated a strong preference for the medium in question. The mean of the liking of video questions was 4.13 ($SD=.76$), the mean of liking of audio questions was 3.54 ($SD=.98$), and the mean of liking of transcript questions was 2.97 ($SD=1.03$). There was a significant main effect of the medium in question on participants' ratings ($F(2, 246)=48.13$, $p<.0001$). Contrasts further revealed that ratings for each medium varied significantly from each other, with video questions as participants' favorite medium and transcripts as participants' least favorite medium (video v. text; $F(1, 246)=19.62$, $p<.0001$).

A confirmatory factor analysis was performed to divide the 19 attitude questions into subscales. This analysis resulted in 5 factors that will be referred to as: (1) video perception (2) audio perception (3) text perception (4) motivation and (5) computer perception. Those factors

accounted for responses to 15 of the survey questions. Responses to questions that did not fit the factors were treated as individual predictors.

Because the medium varied only during intervention, analyses for attitude survey questions focused on performance at the intervention only. **Pretest score, medium, psychological concept, condition,** and **all survey factors and non-fitting survey questions** were used as predictors. In addition, the **interaction between the perceptions of each medium and medium** was also included as predictors to examine the potential impact of perception of a medium and performance when taught with that medium.

Analyses revealed significant effects of pretest and concept ($F(1, 605)=11.68$, $p<.001$; $F(5, 605)=18.38$, $p<.0001$, respectively). Participants' rating of the amount of effort they had to invest to learn ($F(1, 605)=4.40$, $p<.05$) was also significant in predicting performance on questions during the intervention. Higher ratings of performance on audio clip questions predicted better performance during the intervention ($F(1, 605)=3.93$, $p=.048$). In contrast, the less effort participants felt they had to invest predicted better performance during intervention. Lastly, the interaction between the text perception factor and the text medium was significant ($F(2, 605)=3.51$, $p<.05$). More positive perceptions of text questions (e.g., liking transcript questions and ratings of how well participants thought they did on transcript questions) predicted performance on text questions during the intervention.

Discussion

Medium Does Not Matter

Analyses suggest that although prior knowledge and performance during the intervention predicted getting questions correct at posttest, the medium used to teach a concept did not predict performance during the intervention or at posttest. Study 2 did not find significant learning

benefits for video on tasks that measured participants' abilities to apply their knowledge. This finding provide support for the contention that the medium used to teach concepts does not particularly matter, even for more complex learning goals like application skills. It also provides more research on media comparisons in the domain of psychology, an area where this type of research is lacking.

More research is needed on the impact of medium, using materials like the videos used in this study, because instructors use them often. This study allowed the investigation of many concepts, but was limited by the fact that there was only one question asked about each research presentation. Future multimedia research in the domain of psychology would benefit from investigating the differences between single-medium and multimedia presentations using several questions surrounding one concept to isolate learning effects better. In addition, research that looks at more long-term learning effects would be valuable, because one medium may be more beneficial for long-term retention.

In addition, condition was not a significant predictor of getting items correct at posttest. Despite the higher-level cognitive skill (i.e., application) required of participants compared to what was examined in Study 1, they seemed to perform rather well at posttest, regardless of whether they were in the control group or received advance organizers. This may be because the concepts were being discussed in the framework of research, making the application relatively accessible. In particular, by learning about research applications, this may have served as a scaffold for participants to then apply the concepts themselves.

The success participants had regardless of medium is encouraging information for psychology educators, because as discussed in Study 1, single-medium versions of the same content discussed in the video versions do not negatively impact learning. This is particularly

encouraging to see in Study 2, because Study 2 required a more challenging cognitive skill (i.e., application, as compared to recall).

Advance Organizers Boost Performance for Single-medium Instruction

Analyses of performance during the intervention revealed a significant interaction of condition and medium. If participants were taught through audio or text *and* were in the control group, they performed significantly worse on those questions than those who had advance organizers. This effect was not significant for video. The significance of this interaction may be due to the lack of nonverbal cues provided by the transcripts and audio clips as compared to videos. The potential weakness of transcripts and audio clips may have been overcome by the advance organizers such that those in the advance-organizer condition got an extra boost from exposure to the key concepts prior to listening to the audio clips or reading the transcripts. However, it is not clear exactly what the advance organizers provided for the audio and text comprehension that did not impact video. More research is needed to better isolate the impact of advance organizers on single-medium materials as compared to multimedia materials.

This finding is interesting because it suggests that in a classroom scenario, if an instructor is asking students to listen to an audio clip or read an article, they may benefit from simple advance organizers like key terms or concepts. This offers a simple instructional support that can be done easily and quickly. In addition, the advance organizers in this study were provided through videos. Instructors can easily take similar videos of themselves providing advance organizers for online learning or independent learning scenarios.

Note-taking Does Not Matter

Analyses on note-taking suggest that there is no added benefit of taking notes when one has advance organizers. This may be because participants were only told to "take notes" and

were not specifically told what to take notes on other than the cueing to key concepts provided in the advance-organizer condition. Further research needs to be done to isolate the effects of note-taking, but this study found no significant impact of note-taking.

Preferences for Medium of Instruction

Consistent with Study 1, participants in Study 2 also showed significant preference for interacting with the video questions over the audio and transcript questions. Transcript questions were participants' least favorite. This suggests that when possible, instructors should use videos, because students prefer them over audio-only or text-only materials. As discussed in Study 1, using media that students prefer could increase motivation and increase the likelihood that students will seek out instructional videos (e.g., Moreno, 2007; Venkatesh et al., 2003).

Interestingly, the less effort participants felt they had to invest in learning through the quiz, the better their performance during the intervention. This is not particularly surprising, because those participants who performed better at intervention likely viewed their efforts as less taxing, which then impacted their ratings. However, it is an important factor for future research and for educators to consider, because this does suggest that if the learning materials require too much effort, this could negatively impact performance.

The last finding relating to preference for medium of instruction was that more positive perceptions of transcript questions predicted better performance on those questions during the intervention. If performance impacts perception of media, this finding could indicate that participants judged their performance on transcript questions fairly accurately and this played a role in their overall attitudes toward the transcripts. Although surveys were administered after participants answered the questions, it could be the case that perception impacts performance and participants' positive perceptions of transcript questions led to better performance. No

conclusions on the causal direction of these relations can be made until further research on this can be done. It is interesting that this significance did not exist for the video or audio perception factors, but it would be a valuable area to conduct more research to better understand the role attitudes play in learning through different media.

Implications for Teaching

This study, in combination with findings from Study 1, provides valuable information for psychology instructors and findings for future research to build upon. It is particularly interesting that when the same content was presented in video, audio, and text formats, advance organizers benefited the sparser media (i.e., audio and text). This is helpful to examine in future research, and suggests that simply pointing out key concepts prior to audio or text discussions of research helps students apply that knowledge more accurately. This is important because video materials are not always available. This is promising for instructors, because it provides a simple solution to enriching the presentation of single-medium materials.

Study 3 continues research on multimedia, but focuses exclusively on video presentations, for several reasons. First, given the clear preference for video in Studies 1 and 2, more research should be done on psychology videos to make their design and delivery as beneficial for learning as possible. Second, Study 2 demonstrated the positive impact of advance organizers on audio and text questions, but not particularly for videos. Therefore, it is beneficial to identify other instructional supports that may be particularly beneficial for psychology videos. Third, and finally, Study 3 examines different videos from those used in Studies 1 and 2 because, in addition to investigating multimedia across content areas, media also differ within content areas. It is important to embrace the diversity of these materials and to explore their unique benefits and challenges.

Figure 3.1: Performance by medium for control group

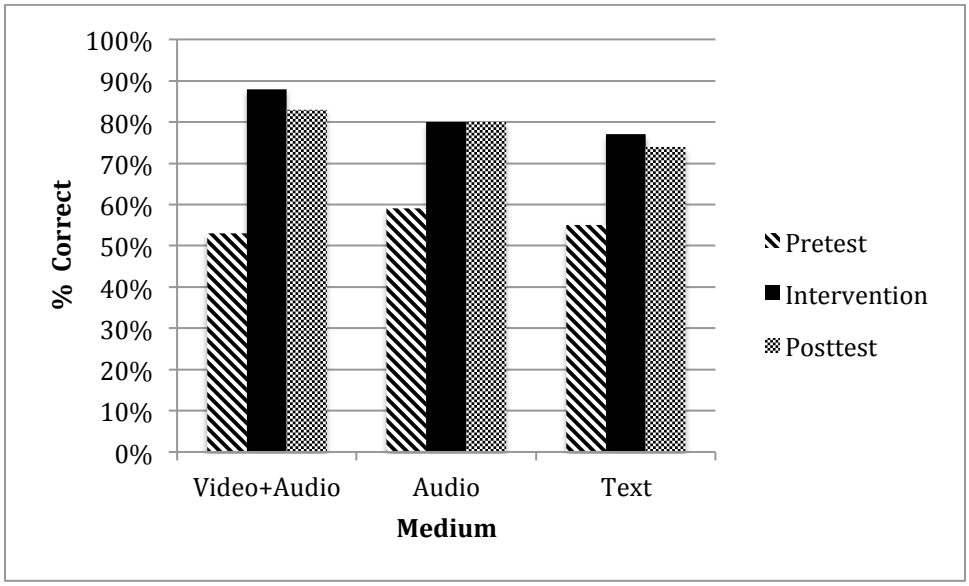


Figure 3.2: Performance by medium for advance-organizer group

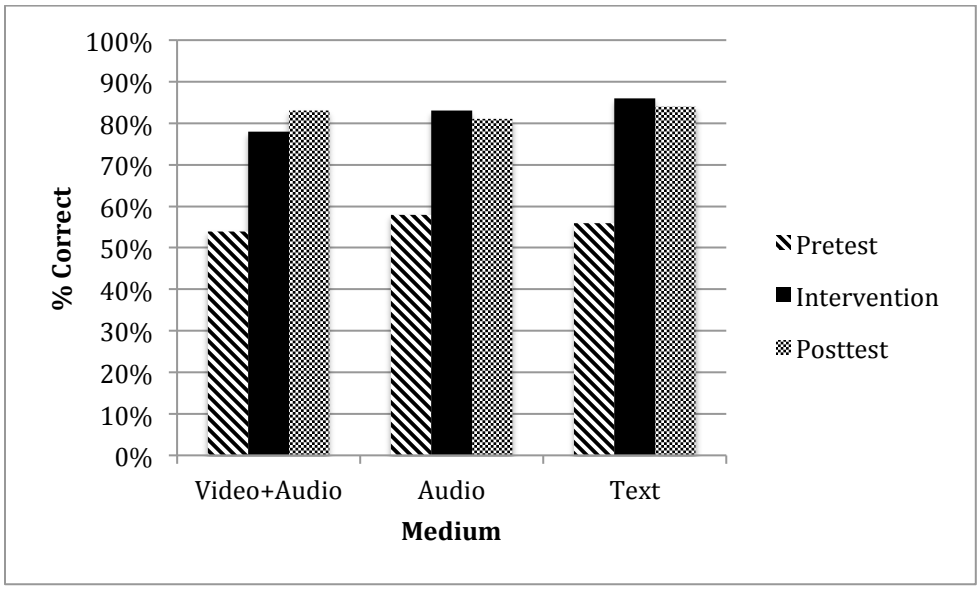


Figure 3.3: Performance by concept for control group

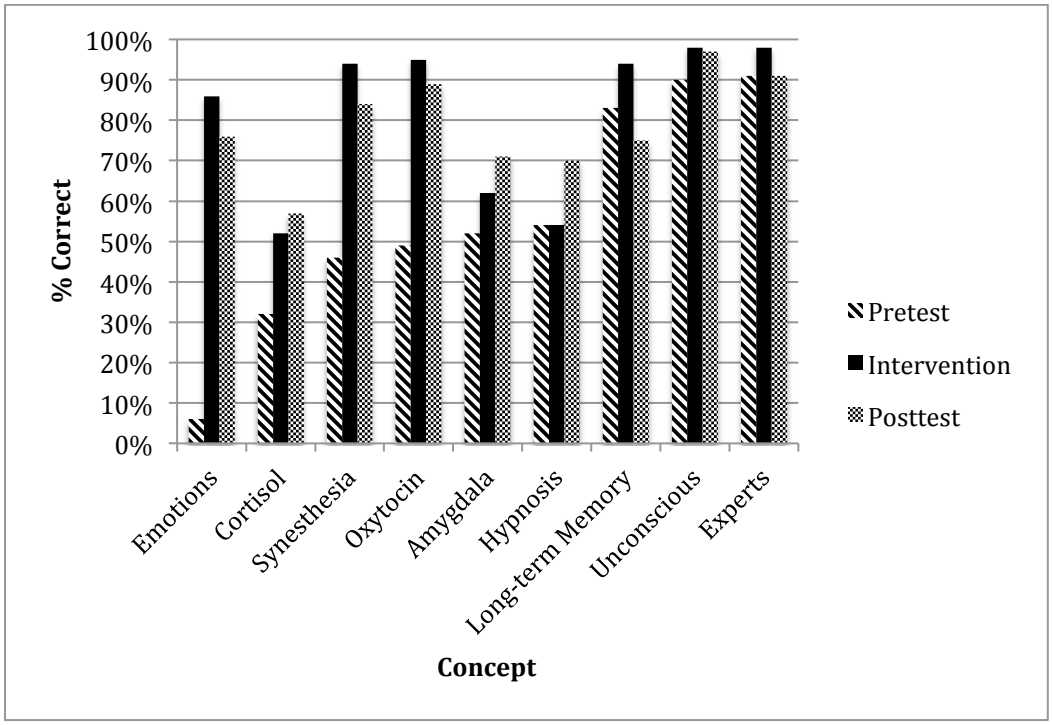
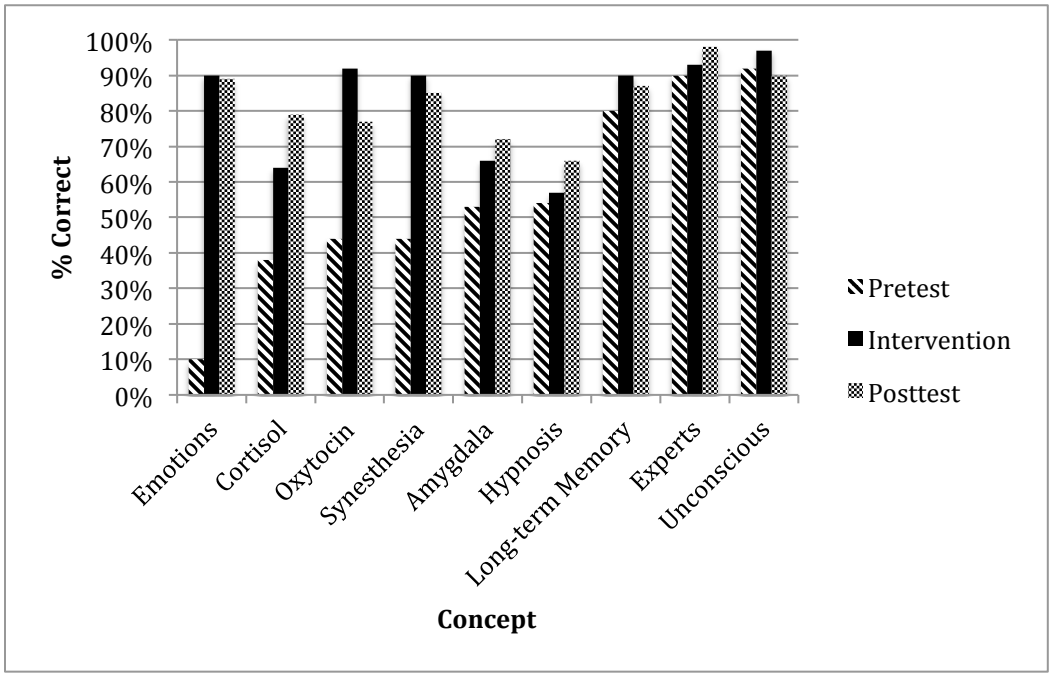


Figure 3.4: Performance by concept for advance-organizer group



CHAPTER 4

DESIGNING VIDEOS TO SUPPORT LEARNING: THE ROLE OF EMBEDDED GUIDANCE (STUDY 3)

Research has established that learners benefit from guidance when interacting with instructional materials (e.g., Herron et al., 1998; Gurlitt et al., 2012; Stull & Mayer, 2007). Multimedia research, more particularly, has advocated for the learner-centered approach, because as media become more complex and dynamic, it is critical to consider the challenges this causes for the learner (e.g., Clark & Mayer, 2011; Norman, 1993; van Es & Sherin, 2002). By focusing attention on the learner, the media are seen not merely as conveyors of knowledge, but also as facilitators in the construction of knowledge (Mayer, 2008; Neo, 2007). This approach acknowledges that just not all media or new technology are equipped or designed for learning (e.g., Bates & Poole, 2003; Clark & Mayer, 2011; Kalyuga, Chandler, & Sweller, 2000). Within this framework, special emphasis is placed on the idea that learners' experiences must be supported. In educational contexts, these supports can be built into the design of the media, provided by the instructor, or a combination of both.

Researchers have examined potential ways to support learners' construction of knowledge in multimedia environments, with a large focus on developing recommendations for the *design* of multimedia presentations (e.g., Mayer & Moreno, 2003; Clark & Mayer, 2011). Mayer (2009) describes the positive impact that 12 design principles may have on learning outcomes in multimedia environments. This paper will focus on just two of these design principles, signaling and segmenting, which informed the instructional supports investigated in this study.

Mayer's (2005b) *signaling principle* suggests that providing cues in multimedia presentations will direct the learner's attention, thereby helping the learner focus on relevant information. In a study designed to help participants understand lift in airplanes, Mautone and Mayer (2001) showed participants animations with narration. In the control group, the narrator explained the process of lift, but did not provide any signals to cue participants to relevant aspects of the process. In the experimental group, the narrator provided signals to cue participants by listing the steps in the process. The experimental group outperformed the control group on transfer tests, suggesting the cues assisted learners in processing and organizing the information. Signaling has been shown to be a helpful principle for animations, but this has not been investigated in instructional videos in psychology. Thus, this study will examine the potential benefit of providing signaling as an instructional support in learning from videos.

In addition to the *signaling principle*, Mayer (2009) suggested that breaking up information into segments supported learning. The *segmenting principle* suggests that multimedia presentations be divided in segments, preferably paced by the user, as this breaks the information to be learned into manageable chunks for the learner. For example, when pre-service teachers watched a 20-minute video that was divided into 7 segments, each focusing on a different teaching technique, they outperformed pre-service teachers who watched the video continuously. Breaking information into smaller segments may be beneficial for learners, even when the video is not very long, because even short videos can contain a lot of information. Segmenting may help the learner process portions of the video, preventing a strain on cognitive resources (e.g., Mayer, 2005b). More recent studies have found similar effects of segmenting, but more research is needed with video, because the variety of videos available is growing (e.g., Ibrahim, Antonenko, Greenwood, & Wheeler, 2012). This variety may impact the effectiveness

of instructional supports, because each type of video has different instructional goals and challenges that may need to be addressed through unique supports.

Although multimedia design principles offer some valuable guidelines, Mayer and colleagues caution that the principles are not universally effective. Factors like multimedia type and content area may impact the effectiveness of the principles (e.g., Clark & Mayer, 2011). This caveat highlights the importance of further research in the design of videos in various content areas, especially content that is not procedural, which is the case for many of the concepts that Mayer has investigated.

Signaling and Segmenting Through Embedded Questions

As more videos are being used for instruction, there has been an increase in the use of embedded questioning by platforms like Coursera, Zaption, etc. However, research on the effectiveness of embedded questions is lacking. Embedding questions in videos could serve to both *signal* learners to relevant information and *segment* videos into more manageable sections. Although embedding questions into the design of videos is becoming easier, much of the research in this area has had to rely on manually pausing videos to ask questions, or providing questions that students can answer while watching videos. This is likely because it is still difficult for instructors to edit videos they do not own. Despite the lack of research on embedded questions, the body of research available (e.g., Lawson et al., 2006; Mills, Herron, & Cole, 2004) on guiding learners' viewing of videos with questions asked preceding or intermittently throughout the video provides insight into the potential effectiveness of embedding questions.

Mills, Herron, and Cole (2004) investigated the impact of teacher-assisted viewing on students' second-language learning. College students watched French educational videos and took comprehension tests. The control group worked independently, watching the videos in a

computer lab and were free to choose when to read and answer the comprehension questions. In the experimental group, teachers paused the videos at various points, directing students when to answer each question. The analyses revealed no significant difference between teacher-assisted viewing as compared to independent viewing.

In contrast, Kreiner (1997) showed psychology students videos on language development in one of four conditions. Students in the control group watched the video without taking notes. Students in one experimental condition took notes while watching the video. Students in a second experimental condition answered 10 questions before watching the video. Students in the last group answered the same 10 questions at various points while watching the video as it was paused by the instructor. Students in the last group performed significantly better when answering questions that required making inferences from the information in the video.

In another study, Lawson, Bodle, Houlette, and Haubner (2006) showed psychology students a video about social psychology. The control group watched the video without instructions. The experimental group answered 8 questions, intended to guide their viewing, while watching the video. Students who received the guiding questions performed better on a test containing video-related questions. Although the questions were not embedded in the design of the video, they did act as guidance *while* viewing the video.

More research is needed to clarify the learning benefits of guiding questions as instructional supports for learning from video. Most of this research advocates for structuring the viewing of videos and suggests that using questions as instructional supports may be beneficial, particularly when the learning outcomes require more than basic comprehension of the videos. According to multimedia learning theory, providing questions may help signal learners to

relevant information and embedding questions into the video design may help learners segment their learning.

More research on guiding videos could help inform their design and delivery. This could have important implications for instructors. For example, although it is easier for instructors to pause videos as was done in Kreiner (1997) as opposed to editing a video, pausing a video in class many times may be distracting, inconvenient and inconsistent. Media developers may want to consider how instructional supports like questions can be embedded in design to help instructors deliver multimedia more effectively. This research also contributes to our developing knowledge about best practice for online learning platforms like Coursera that deliver massively open online courses (MOOCS).

Current Study

Study 3 continues investigation of learning about psychology from video, given that much of the previous work on learning from video has looked at procedural learning and thus psychology presents an important contrast. Video is also important to investigate further given participants in the two previous studies clearly favored learning from video over learning from text or audio. Study 2 suggested that advance organizers helped learners make sense of single-medium materials; Study 3 focuses on supports that might help learners make sense of video. In Study 2, the supports offered (advance organizers and suggestions to take notes) did not improve performance when learning from video; in this study, supports are derived from Mayer's design principles and participants will either have the concepts signaled or have the videos segmented.

The key feature of the instructional support added in Study 3 is that guidance for one of the experimental group is built into the design of the videos. The embedded guidance in the current study utilizes signaling, segmenting, and guiding questions built into the design of the

videos. There are a growing number of tools available online for educators to provide supports like those used in Study 3 (e.g., zaption.com). These websites allow educators opportunities to edit videos to include questions throughout the videos, captions, etc. Because resources like these are growing, it is important to examine the learning benefits of such embedded guidance and how these supports may generalize to different materials both across and within domains. In addition, this study also continues looking at attitudes toward learning experiences with these videos.

As technology advances, there is more to learn about how to assist learners in the exciting but potentially daunting world of multimedia. The most effective guidance could vary greatly depending on medium, learning goals, learners' knowledge, etc. which makes research across domains and media essential. The goal of the current study is to contribute to this growing body of research.

Method

Participants

This study consists of data from 135 participants (97 females and 38 males). The average age of participants was 21 years old. Participants were enrolled in educational psychology and psychology courses at a large university in the Midwest. The average number of psychology classes taken in high school was .5 (SD=.6). The average number of psychology classes taken in college was 2.25 (SD=2.05).Participants received research credit for participating in this study.

Materials

Videos. This study used different videos from those used in Studies 1 and 2. New videos were produced and edited to intentionally include embedded guidance, the focus of this study. The videos were developed for an Introduction to Psychology textbook. They demonstrate

psychological concepts in the classroom that students can watch in class, at home, or in an online course to help them apply concepts from the course. Examples of the videos for all conditions are given in the Procedure, and in Appendix C.

Nature of guidance. Two conditions for guiding participants' viewing of videos were investigated in this experiment, drawing from research in this area (e.g., Clark & Mayer, 2011; Mayer, 2005a). The first condition replicated the manipulation in Study 2, by using the same advance-organizer approach, along with suggestions to take notes. This manipulation was replicated here because different videos were used, so the effect of the particular video stimuli might be disentangled from the type of guidance. For example, if advance organizers help learners in Study 3, then some conclusions can be drawn about advance organizers' ability to help *under certain* conditions; if the advance organizers do not help learners in Study 2 or Study 3, there will be mounting evidence that advance organizers are not useful supports for information presented in video. The second condition embedded the guidance directly into the video. In this second condition, participants were required to respond, rather than provided with a suggestion to respond, as in the advance-organizer condition. For example, in the embedded-guidance videos, participants were prompted to write down information while watching the video.

All participants watched at least 2 content videos. Two videos were chosen because the videos contain many terms and require a significant amount of work from the participant (e.g. note-taking, answering questions on all the terms). In addition, these two particular videos were chosen because they cover concepts that are particularly difficult for psychology students, and students often confuse the two concepts. Lastly, the concepts lend themselves well to video demonstrations. The concepts covered in the videos were (1) operant conditioning and (2)

classical conditioning, and terms associated with these concepts (e.g. positive, negative, unconditioned stimulus, conditioned stimulus).

Delivery of videos. To deliver the videos, this study used the same quiz portion of the online learning management system (LMS) used in Studies 1 and 2. All participants accessed this LMS on a desktop Mac computer in the lab (a large room with 3 desks, each equipped with a computer).

Chapter excerpts. In addition to watching the videos, participants read an excerpt from an Introduction to Psychology textbook that describes the concept(s) they were about to learn (See Appendix C for example). All participants were able to take notes on the excerpt, but were simply told, "Study this as you normally would," and were provided with a pen. The excerpt was necessary because the videos required some familiarity with the terms covered in them. The entire session mimicked a scenario in which a student reads a chapter prior to coming to class, and videos are shown in class to reinforce the content they just read.

Notes. Participants in both experimental conditions were provided with 2 sheets of paper. The top of each paper denoted the question number, one for each video (e.g. "Question One"). More details on note-taking are described in the Procedure.

Surveys. In addition to completing the study, participants completed the same short survey of biographical information used in Studies 1 and 2. Participants also completed a modified version of the attitude survey used in Studies 1 and 2. This survey was modified to eliminate items that addressed the different media because this study focused solely on video.

Design

All participants were tested on the same concepts. Participants were randomly assigned to one of three groups: (1) control (no-guidance) (2) advance organizer and (3) embedded guidance.

Procedure. Each participant first took a survey then took the pretest, then read chapter excerpts, then participated in one of the three conditions, and then took the posttest and final survey.

Pretest. The pretest questions were designed to measure participants' prior knowledge of concepts they would be tested on at posttest. Pretest questions were randomized. The participants answered 26 questions on the LMS. The pretest consisted of 13 questions and the posttest consisted of 13 questions. Eight of the questions pertained to the operant conditioning video and five pertained to the classical conditioning video. More questions were asked about the first video because it covered more terms. The questions targeted key terms demonstrated in the videos (e.g., unconditioned response, conditioned response, etc.). Each participant was tested individually, and a maximum of 3 participants were in the lab at one time. Every participant used headphones during the experiment. All questions asked participants to apply what they learned.

Reading the chapter excerpts. All participants read a chapter excerpt prior to watching the videos (see Appendix E). They were able to take notes if they wanted, but were not allowed to reference their notes while watching the videos or answering posttest questions.

Control group. After the pretest, participants in the control group read the chapter excerpt and then watched the 2 videos. After watching the videos, they moved on to the posttest.

Advance-organizer group. Participants in this group watched a short (25-28sec) advance-organizer video before they watched the operant conditioning video and before they watched the classical conditioning video. The videos differed slightly, depending on the content but the template was, "Take notes you watch this demonstration, pay attention to key terms like [concepts]. Also think about how the demonstration might apply to other situations." The goal of these advance-organizer videos was to help participants focus on important information. After

viewing the advance-organizer video, participants indicated they were ready to move to the demonstration video (either operant or classical conditioning). They then watched the video. Before taking the posttest, participants put away any notes. This was to prevent participants from referencing their notes while answering posttest questions.

Embedded-guidance group. Participants in this group watched the same demonstrations, with additional guidance embedded in them. For example, the video paused at various points and prompted participants to write down key terms or posed questions participants could answer in their notes. Before taking the posttest, participants put away their notes. This was to prevent participants from referencing their notes during posttest questions.

Although the nature and placement of the guidance differed between the two experimental groups, all groups received the information about key terms. All groups knew the key terms that were the focus of the demonstration.

Posttest. After watching the videos, each participant took a 13-question posttest. Posttest questions were randomized. The posttest questions were modified versions of the pretest and were nearly identical to the pretest questions.

Surveys. Before beginning the study, participants completed a short survey of biographical information. After participants completed the study, they were given attitude surveys.

Results

Five participants did not complete the study and were removed from all analyses, leaving 135 participants for analyses. There were 44 participants in the control group, 46 participants in the advance-organizer group, and 45 participants in the embedded-guidance group.

Descriptive Statistics

The average pretest score was 6.61 (*SD*=2.92). The average posttest score was 8.16 (SD=3.1). Figure 4.1 shows the distribution of performance at pretest and posttest for each of the groups (control, advance-organizer group, and embedded-scaffolding group) for the classical conditioning terms. Figure 4.2 shows the distributions for the operant conditioning terms. The mean number of correct responses on the pretest for the control group was 6.45 (*SD*=3.06). The mean number of correct responses on the pretest for the advance-organizer group was 6.6 (*SD*=2.78). The mean number of correct responses on the pretest for the embedded-guidance group was 6.78 (*SD*=2.99). There was no significant difference between the groups' pretest scores, ($F(2, 132)=.13$, $p=.87$).

Analyses of Pre- and Posttest Performance

A mixed-model analysis with a hierarchical structure was utilized to account for the fact that questions were nested in participant because the characteristics of each participant could have impacted their performance on each question. Therefore the nested nature of the data was taken into account by considering the random effects of participant, but the nature of the questions was the focus (e.g., concept, performance, etc.). Questions were level 1 and participant was level 2 for all analyses.

One of the primary areas of interest was the impact of condition on performance at posttest. The model used to investigate this included **pretest score**, **condition,** the **specific psychological concepts** (e.g., positive reinforcement, unconditioned stimulus) and **general psychological concepts** (i.e., operant or classical conditioning) as predictors and **posttest** as the outcome variable. This analysis revealed significant effects of pretest ($F(1, 1607)=92.82$, $p<.0001$), specific concept ($F(11, 1607)=11.25$, $p<.0001$), and general concept ($F(1, 1607)=23.14$, $p<.0001$). Classical conditioning was a more difficult topic than operant

conditioning. Analyses were conducted looking at classical conditioning concepts and operant conditioning concepts separately, which still did not result in significant effects of condition.

Although condition was not significant ($F(2, 1607)=.96$, $p=.38$), it appeared that the control group performed the worst and the embedded guidance group performed the best on the posttest. More specifically, with all 13 concepts in the dataset, the mean posttest score of the control group was 7.73 ($SD=3.45$), advance-organizer group was 8.20 ($SD=2.78$), and embedded-guidance group was 8.56 ($SD=3.07$).

Because both the concept and performance at pretest accounted for significant amounts of the variance in posttest performance, follow-up analyses were conducted after eliminating concepts on which participants' average pretest scores were 80% or better. Data were reanalyzed after removing 2 concepts (positive reinforcement and reinforcement), leaving 11 concepts. Pretest, specific concept, and general concept were all significant ($F(1, 1339)= 86.07$, $p<.0001$; $F(9, 1339)= 10.42$, $p<.0001$; $F(1, 1339) = 7.13$, $p<.05$ respectively). Condition was not significant ($F(2, 1339)=.81$, $p=.45$), but performance still followed the same trend, with the control group performing the worst (6.02, $SD=3.22$), the advance-organizer group in the middle (6.30, $SD=2.76$) and embedded-guidance the best (6.71, $SD=3.07$) on the 11 concepts at posttest.

Attitudes

There were 10 questions on the attitude survey. All questions were taken from Study 2. A confirmatory factor analysis was performed to divide the 10 attitude questions into subscales. This analysis resulted in 2 factors that will be referred to as: (1) motivation and (2) computer perception. Those factors accounted for 8 of the survey questions. The 2 questions that did not fit the factors were treated as individual predictors.

Pretest, specific psychological concept, condition, both **survey factors** and **non-fitting survey questions** were used as predictors. In addition, the interactions between each factor, non-fitting question and condition were also included as predictors to examine the potential impact of condition and attitude on performance. Performance at posttest was the outcome. Analyses revealed a significant effect of pretest and specific concept ($F(1, 1339)=84.68$, $p<.0001$; $F(10, 1339)=9.85$, $p<.0001$, respectively). Survey question 6, which asked about the level of effort participants had to invest in learning the psychology concepts, was also a significant predictor of performance at posttest ($F(1,1339)=11.30$, $p<.01$). The less effort participants felt they had to invest in learning the psychology concepts predicted better performance at posttest.

Discussion

Demonstration Videos Need Instructional Support

Students have difficulty learning about classical and operant conditioning and this study examined the impact of videos demonstrations of these difficult psychology concepts, with varying supports. Analyses suggest that although the participants learned from watching these videos, the variations in the instructional supports did not differentially impact performance at posttest, although the trend in performance was as predicted. That is, those in the control group performed the worst and those in the embedded-guidance group performed the best. Embedding guidance in the form of questions and attention cues may be a step in the right direction to support learning with these types of videos. Performance even for the embedded guidance group was still fairly low (i.e., mean posttest score was 6.71/11). This suggests that these types of psychology videos, although they positively impacted student understanding, still need improvement.

Perceptions of Effort

Ratings of how much effort participants felt it took to learn the psychology concepts was a significant, but negative, predictor of performance. Because this came up as significant question in both Studies 2 and 3, it would be valuable for future research to examine this factor further. It would be interesting to know, for example, if learners perceived learning through certain instructional media in psychology as more effortful than others.

Implications for Teaching

The findings from this study demonstrate that learning from these types of psychology videos are difficult, even when provided with guidance. This is an important factor to consider, because if these videos are difficult for learners to process and apply, more needs to be done to investigate how to support experiences with these videos. Embedding guidance in videos like these may be a valuable goal for the design of these videos, because it provides built-in instructional supports. Given that the results were positive but not significant in this investigation, additional research on embedded supports is needed before conclusions are drawn. This research is important particularly given the growing popularity of instructional videos in independent learning environments like online courses. Embedded supports may be a promising way to support learners when instructors are not available so learning and engagement do not suffer in online environments.

Figure 4.1: Performance on classical conditioning questions by condition

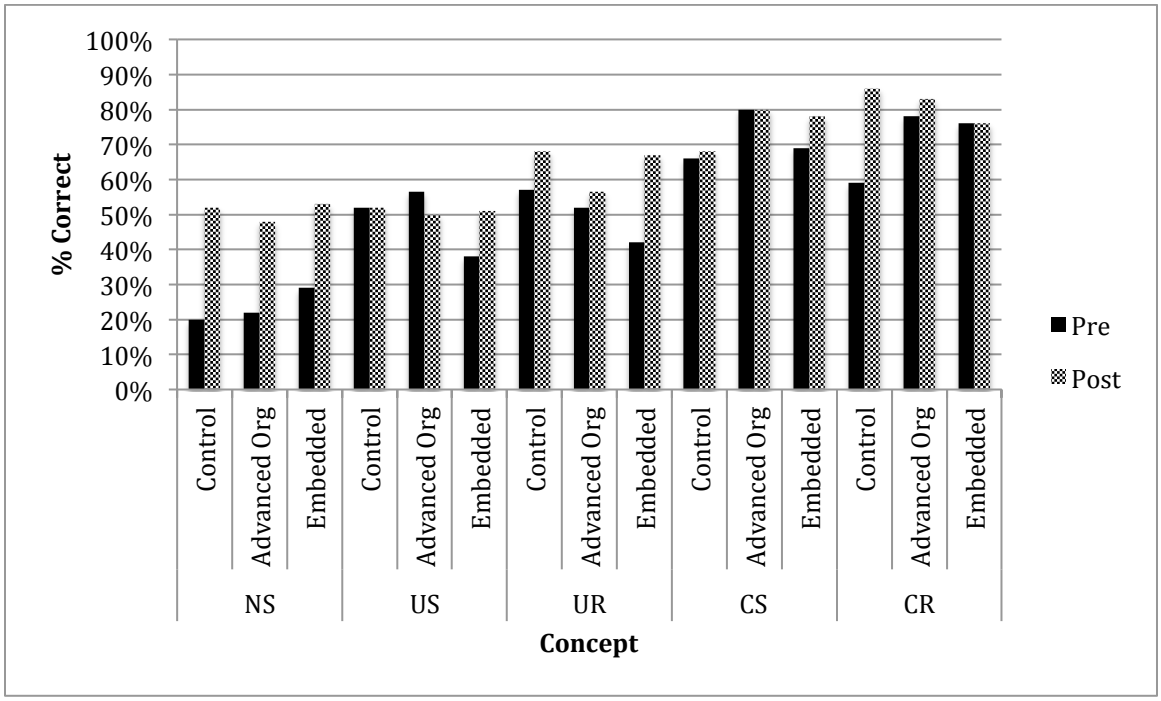
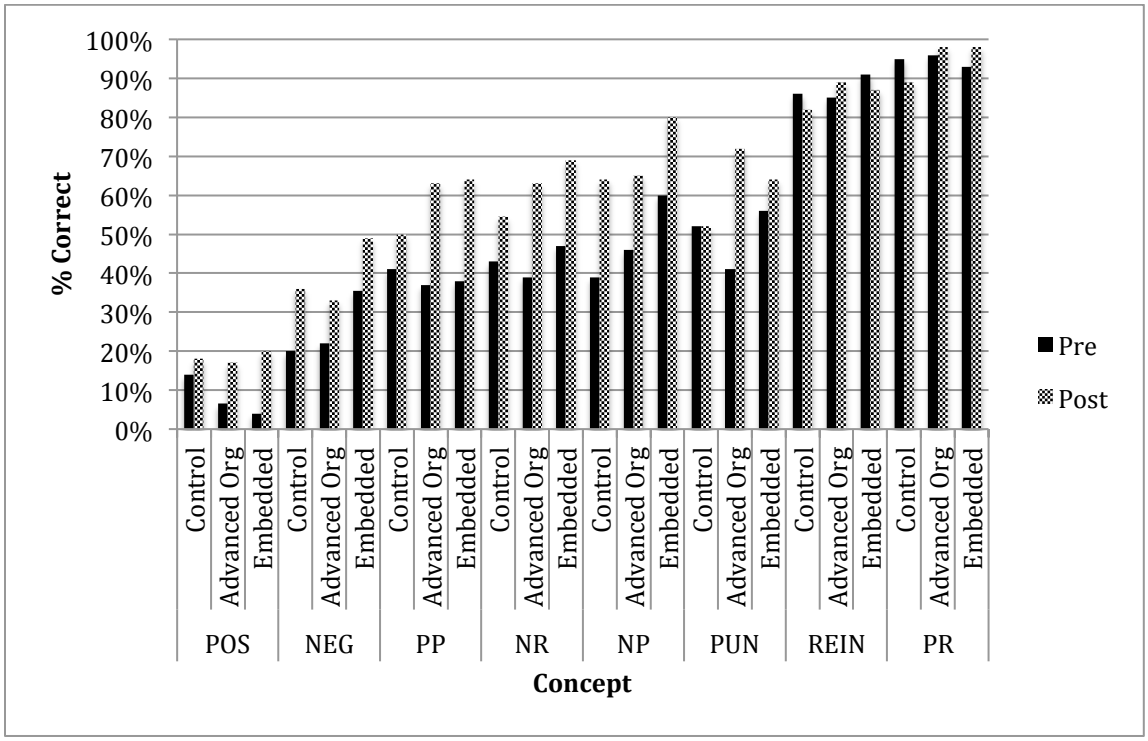


Figure 4.2: Performance on operant conditioning questions by condition



CHAPTER 5

CONCLUSIONS AND FUTURE DIRECTIONS

The goal of the studies included in this dissertation is to inform media use and design in psychology instruction. As someone who is passionate about teaching psychology and about how media impacts learning, it is important to me that research in these areas provides effective and practical suggestions for improving learners' interactions with media. The findings of these studies illustrate some important issues for researchers and psychology educators to consider when using the types of multimedia used in this research.

First, the videos like those used in these studies may not be particularly beneficial for learning as compared to single-medium versions when instructional goals target retention and application skills. Studies 1 and 2 demonstrated that presenting the same information in video did not significantly improve learning outcomes relative to presenting that information in audio (taken directly from the video) or text (transcripts of the audio). This is not bad news. Instructors will continue to use single-medium materials to communicate content and the findings from the studies presented here suggest that learning does not suffer from low-tech presentation of information. It is encouraging that, for the type of information presented in the research discussions in Studies 1 and 2, presenting that information in a single medium—audio or text—did not appear to negatively impact learning relative to presenting that information in a multimedia format—video.

However, Studies 1 and 2 also demonstrated that participants had strong preferences for videos, indicating that, when possible, videos are valuable instructional multimedia to integrate into psychology instruction. Because students like them more, this could have positive impacts on motivation and desire to use videos in independent learning environments.

Studies 2 and 3 also provided valuable information about how to support learning from both single-medium and multimedia instructional materials in psychology. More specifically, the advance organizers and note-taking provided in Study 2 proved to be particularly helpful when participants were taught through audio-only or text-only media. This suggests that when the input is relatively sparse, having instructional support, beyond the content alone, can be valuable.

Finally, Study 3 revealed that videos of demonstrations, like those typically used in psychology classrooms, are difficult for students to understand when students are required to apply what they have learned in the demonstrations. This is important because even though video is multimedia in nature and students like it more, multimedia may not assist students in their learning of challenging concepts like those used in these demonstrations. Demonstrations in psychology are often done in the classroom. However, using videotaped demonstrations are popular, because they save valuable class time, as the instructor does not need to take time to perform the demonstration in class. Identifying that videos of demonstrations are challenging for students is important so educators can develop more effective ways to support learning from these materials.

There were several limitations of the studies presented here that would be valuable to address in future research. Generally, the type of media and time constraints limited opportunities to explore other types of psychology videos and their single-medium formats. For example, it would be interesting to look at videos of lectures, because these are becoming popular with the explosion of online learning. In addition, it would be interesting to see how various media impact not only immediate learning, which is what was investigated here, but also long-term retention. It is possible that the images from videos support retention in ways that text alone or audio alone do not. Furthermore, each study tested student learning with particular types

of questions (retention and application). It is possible that impacts of various media on student learning may be differentially realized depending on how learning is measured. Finally, these studies were not done in the classroom. However, because the goal of this research is to understand more about how media may be impacting students' learning in psychology classrooms, it would be beneficial to do similar studies in classroom or online learning contexts.

Despite these limitations, this collection of studies contributes to our current knowledge about how media, particularly videos, audio-clips, and transcripts impact learning of psychology content. Hopefully, this knowledge will contribute to thoughtful use of media in psychology classrooms, and to encourage research that identifies effective ways to support learning taking into account the unique demands of learning materials and content areas.

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APPENDIX A

STUDY 1 MATERIALS

Note: Materials included here were Adapted from PSYCHOLOGY IN YOUR LIFE by Sarah Grison, Todd Heatherton, and Michael Gazzanigna. Copyright © 2015 by W.W. Norton & Company, Inc. Used by permission of W.W. Norton & Company, Inc.

Biographical Survey

1. What is your gender?

1. Male

2. Female

2. Choose what group best describes you (You can choose more than one):

a. White/Caucasian (Not of Hispanic origin: All persons having origins in any of the original people of Europe, North Africa, or the Middle East)

b. Black/African-American (Not of Hispanic origin: All persons having origins in any of the black racial groups in Africa)

c. Hispanic/Latino (All persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race)

d. Asian/Pacific Islander (All persons having origins in any of the original people of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands)

e. American Indian or Alaskan Native (All persons having origins in any of the original people of North America, and who maintain cultural identification through tribal affiliation or community recognition)

3. What is your date of birth? (mm/dd/yyyy) _____

4. What year are you?

a. Freshman

b. Sophomore

c. Junior

d. Senior

e. Graduate Student

5. How many psychology classes have you taken at the high school level?

Name the class(es) if you remember them

---

6. How many psychology classes have you taken at the college level?

Name the class(es) if you remember them

Pretest/Posttest Questions

Note: Pretest and posttest questions were nearly identical. Participants were instructed to choose the BEST answer.

(1) When people experience stress, they will release a hormone called_____.

a. testosterone
b. cortisol
c. norepinephrine
d. estrogen

Note: participants received credit for choosing either b or c in the above question

(2) Events that elicit _____are more likely to be stored in memory.

a. emotions
b. thoughts
c. personalities
d. delusions

(3) Hugging and kissing results in an increase in this hormone associate with bonding:_____.

a. cortisol
b. GABA
c. testosterone
d. oxytocin

(4) People perceiving different colors as sounds may have_____.

a. blindsight
b. synesthesia
c. colorblindness
d. pareidolia

(5) When one does something without awareness of their actions, it is _____ behavior.

a. conscious
b. unconscious
c. cognizant
d. objective

(6) Individuals who are unskilled in an area can engage in deliberate practice and become _____.

a. rookies
b. coaches
c. experts
d. novices

(7) Emotions and basic instincts are regulated by the _____.

a. occipital lobe
b. frontal lobe
c. amygdala
d. hippocampus

(8) When a therapist tries to teach a patient to calm his or her own fears, the therapist may use_____.

a. transcranial magnetic stimulation
b. electroencephalograms
c. subliminal perception
d. hypnotic suggestion

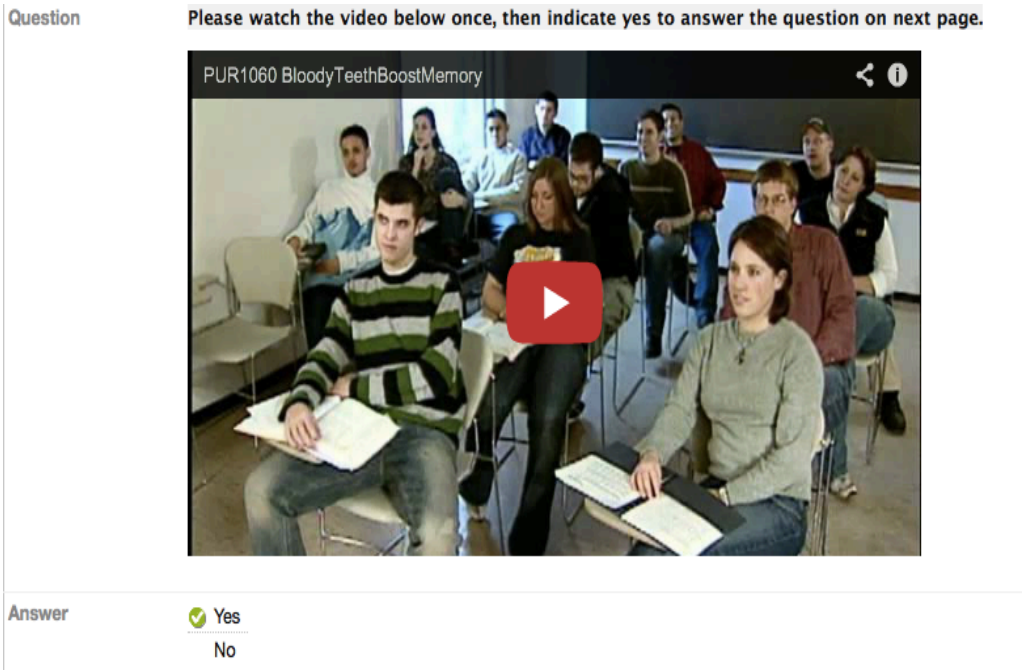
(9) An adult's ability to remember events from childhood is an example of _____ memory.

a. long-term
b. short-term
c. working
d. sensory

Video, Audio, and Transcript Instructions

Note: Following each discussion of research, participants would receive one intervention question. The same materials were used in Study 2. Adapted from PSYCHOLOGY IN YOUR LIFE by Sarah Grison, Todd Heatherton, and Michael Gazzanigna. Copyright © 2015 by W.W. Norton & Company, Inc. Used by permission of W.W. Norton & Company, Inc.

Video.



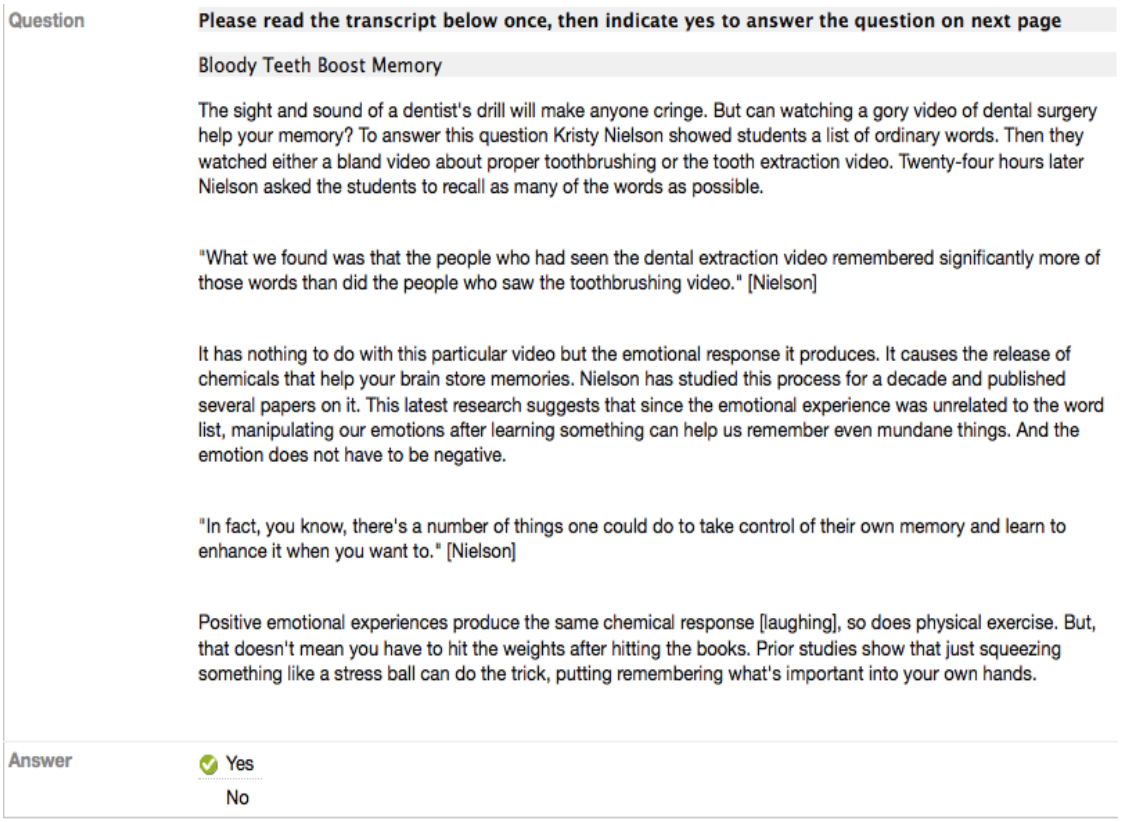
Audio.

Please listen to the audio below once, then indicate yes to answer the question on next page.

[link to audio]

Answer: Yes
No

Transcript.



Question

Please read the transcript below once, then indicate yes to answer the question on next page

Bloody Teeth Boost Memory

The sight and sound of a dentist's drill will make anyone cringe. But can watching a gory video of dental surgery help your memory? To answer this question Kristy Nielson showed students a list of ordinary words. Then they watched either a bland video about proper toothbrushing or the tooth extraction video. Twenty-four hours later Nielson asked the students to recall as many of the words as possible.

"What we found was that the people who had seen the dental extraction video remembered significantly more of those words than did the people who saw the toothbrushing video." [Nielson]

It has nothing to do with this particular video but the emotional response it produces. It causes the release of chemicals that help your brain store memories. Nielson has studied this process for a decade and published several papers on it. This latest research suggests that since the emotional experience was unrelated to the word list, manipulating our emotions after learning something can help us remember even mundane things. And the emotion does not have to be negative.

"In fact, you know, there's a number of things one could do to take control of their own memory and learn to enhance it when you want to." [Nielson]

Positive emotional experiences produce the same chemical response [laughing], so does physical exercise. But, that doesn't mean you have to hit the weights after hitting the books. Prior studies show that just squeezing something like a stress ball can do the trick, putting remembering what's important into your own hands.

Answer

Yes

No

Intervention Questions

(1) The ability to perceive more information and remember more thought processes is a skill that _____ have.

a. novices
b. experts
c. rookies
d. leaders

(2) The act of giving excites areas of the brain that are not activated by receiving. An individual also produces the "cuddle hormone," called_____.

a. serotonin
b. oxytocin
c. androgen
d. dopamine

(3) After learning something, manipulating our _____ can help us remember even mundane things.

a. display rules
b. somatic markers
c. senses
d. emotions

(4) When they saw new faces, adults who were shy as babies showed unusually high activity in a part of the brain called the _____.

a. frontal lobe
b. parietal lobe
c. hippocampus
d. amygdala

(5) Not comprehending one's native language can be brought about by _____.

a. language immersion
b. hypnotic suggestion
c. subliminal perception
d. religious ecstasy

(6) Participants rated women wearing red as more desirable. Participants were not aware of the effects of the color red, because their reactions were_____.

a. explicit
b. objective
c. unconscious
d. conscious

(7) In their studies with rats, researchers were able to block a molecule, which seems crucial to preserving _____ memories.

a. short-term
b. sensory
c. long-term
d. false

(8) After seeing a silent video with moving flashes of light, Johannes claimed to both see the movement and also hear sounds. People like Johannes have a condition called_____.

a. blindsight
b. apophenia
c. colorblindness
d. synesthesia

(9) Telemarketers who played a video game aimed at reducing the threat of social perception had 17% less of the stress hormone called_____.

a. estrogen
b. growth hormone
c. cortisol
d. epinephrine

Intervention Questions

(1) Based on the research just described, choose the best answer. Paulina is an expert nurse treating a patient named Tommy. Which of the following is most likely true?

a. Paulina will be unable to recall information about Tommy's illness and treatment plan
b. Paulina was born with a natural talent that will help her treat Tommy
c. Paulina will not recall the thoughts she had when treating Tommy
d. Paulina will notice many significant details about Tommy's illness and treatment plan

(2) Penelope goes to a holiday party at work and experienced an increase in her oxytocin levels. Based on the research just described, it is most likely that Penelope is_____.

a. Giving a co-worker a gift
b. Relaxing at her table
c. Receiving a gift from a co-worker
d. Fighting with a co-worker

(3) Tommy wants to use the findings from the study just described to help his students remember terms for their biology test. To increase his students' memory after seeing the terms, he should_____.

a. Prevent students from rehearsing the terms
b. Show students a scary movie
c. Teach students in a different room from the one used to test the terms
d. Tell students to look at their teeth in the mirror

(4) Based on the study just described, if adults who weren't shy as babies were shown familiar faces and new faces, what would you expect to find?

a. Similar activity in the amygdala for both familiar and new faces
b. High activity in the amygdala for new faces
c. No activity in the amygdala
d. High activity in the amygdala for familiar faces

(5) Assume the findings of the study just described apply to other automatic behaviors like smoking. Mike is going to therapy to quit smoking. What would be most likely to help Mike, based on the findings of the study?

a. Immersion in a culture that does not smoke
b. Suggestions from a therapist that smoking is easy to quit and that Mike does not want a cigarette
c. The placement of a special chemical on the cigarette so that it tastes badly to Mike
d. Giving Mike a drug that mimics the effects of dopamine when he has a cigarette

(6) Choose the best answer based on the findings of the study just described. John meets his friends Amber and Sandra, who are identical twins, at a coffee shop. Amber is wearing a red dress. Sandra is wearing a blue dress. John is most likely to_____.

a. Think Amber is very attractive and know it's because of the red dress
b. Think Amber is less attractive and know it's because of the red dress
c. Think Amber is very attractive and not know it's because of the red dress
d. Think Amber is unkind and not know it's because of the red dress

(7) For the study just described, imagine the findings also applied to humans, and choose the best answer. Maggie was given the same drug that was given to the rats. As a result, Maggie will_____.

a. Lose childhood memories
b. Lose the ability to form new memories
c. Increase her memory span
d. Increase her memory duration

(8) Assume the findings of the study apply to people outside the lab, and choose the best answer. Maya was recently diagnosed with the same type of synesthesia as the man just described. Maya goes to a silent movie with her friend who does not have synesthesia. What is Maya most likely to experience as compared to her friend?

a. Maya will have more difficulty distinguishing subtle differences in the movement of the actors
b. Maya will have more difficulty seeing colors in the theater
c. Maya will be better able to distinguish subtle differences in the movements of the actors
d. Maya will see different colors in the movie that her friend does not see

(9) Use the findings of the study just described to choose the best answer. Imagine Mila is playing a game that has her focus on negative aspects of her life. Mila is most likely to _____.

a. Experience a decrease in cortisol levels
b. Experience an activation of her parasympathetic nervous system
c. Experience an increase in cortisol levels
d. Experience a constriction of her pupils

Attitude Survey

Please rate the degree to which you agree with the following statements.

1. I liked the questions that included videos.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Add additional comments if you'd like:

---

2. I liked the questions that included audio clips.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Add additional comments if you'd like:

---

3. I liked the questions that included transcripts.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Add additional comments if you'd like:

APPENDIX B

STUDY 2 MATERIALS

Note: Materials included here were Adapted from PSYCHOLOGY IN YOUR LIFE by Sarah Grison, Todd Heatherton, and Michael Gazzanigna. Copyright © 2015 by W.W. Norton & Company, Inc. Used by permission of W.W. Norton & Company, Inc.

Pretest/Posttest Questions

Note: Pretest and posttest questions were nearly identical. Participants were instructed to choose the BEST answer.

(1) Damon is an expert chess player. John is a novice chess player. Based on your knowledge of expertise, which of the following is most likely true?

a. John is able to notice meaningful patterns in Damon's strategy

b. Damon is able to change strategies quickly based on John's moves

c. Damon will need to use all his attentional resources to plan his next move

d. John has more knowledge of chess than Damon

(2) Jared has a disease that has caused damage to his amygdala. As a result of this damage, what is Jared likely to experience?

a. Jared will have significant trouble with his vision

b. Jared will have significant trouble with his speech production

c. Jared will have trouble understanding the speech of others

d. Jared will have trouble experiencing

(3) Sandra's oxytocin levels are elevated. Sandra is most likely _____.

a. Sleeping in bed

b. Resting on a beach

c. Going to the grocery store

d. Holding her baby

(4) Jack is camping and has encountered a bear. He is terrified. Jack is most likely experiencing which of the following?

a. Activation of his parasympathetic nervous system

b. An increase in his cortisol levels

c. A decrease in his cortisol levels

d. Constriction of his pupils

(5) John is trying to remember a list of terms for his art history class. If John wants to increase his memory for those terms after seeing them, he should _____.

a. Read a scary story

b. Drink coffee while he studies the terms but not when he's tested on them

c. Highlight all the terms

d. Avoid splitting up terms into meaningful topics

(6) Thelma is trying to store a list of psychology terms in her long-term memory. To know whether she was successful, Thelma should _____.

a. Rehearse the terms in her head as she reads them

b. Wait 15 seconds and then try to recall them

c. Try to recall the terms the day after she reads them

d. Read the terms in the classroom she'll be tested in

(7) Will is seeking therapy to control his fears, that helps him to be calm, and that's non-invasive. He chooses hypnosis. Which of the following is most likely to be part of Will's therapy?

a. A therapist will tell Will he is a calm person who enjoys new experiences

b. A therapist will administer glucose-like molecules to Will's brain

c. A therapist will slowly expose Will to objects and situations he fears

d. A therapist will show Will abstract pictures and ask what Will sees

(8) Isabella has synesthesia. What is Isabella likely to experience?

a. Isabella will perceive a color when someone tells her their name

b. Isabella will only be able to remember information for 5 seconds

c. Isabella will never forget information

d. Isabella will not be able to see colors

(9) Barbara is engaging in an unconscious process. Barbara is most likely _____.

a. Taking a new class in college

b. Learning how to ride a bike for the first time

c. Driving the same route she drives every day

d. Driving a new car she's not familiar with

Attitude Survey

Please rate the degree to which you agree with the following statements.

1. I liked the questions that included videos.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Add additional comments if you'd like:

---

2. I liked the questions that included audio clips.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Add additional comments if you'd like:

---

3. I liked the questions that included transcripts.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Add additional comments if you'd like:

---

4. I did well on the video questions.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

5. I did well on the audio clip questions.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

6. I did well on the transcript questions.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

7. Video questions are a good idea.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

8. Audio clip questions are a good idea.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

9. Transcript questions are a good idea.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

10. My overall experience with the quiz was positive.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

11. It was interesting to learn about psychology concepts today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

12. I would be eager to learn about psychology concepts in the same conditions I learned them today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

13. It was motivating to learn about psychology concepts today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

14. It was difficult to learn the psychology concepts in the conditions I learned them today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

15. I had to invest a lot of effort to learn the psychology concepts in the conditions I learned them today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

16. Using computers is a good idea.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

17. I like using computers.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

18. Computers make work more interesting.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

19. Working with computers is fun.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

APPENDIX C

STUDY 3 MATERIALS

Note: Materials included here were Adapted from PSYCHOLOGY IN YOUR LIFE by Sarah Grison, Todd Heatherton, and Michael Gazzanigna. Copyright © 2015 by W.W. Norton & Company, Inc. Used by permission of W.W. Norton & Company, Inc.

Pretest/Posttest Questions

Note: Pretest and posttest questions were nearly identical. Participants were instructed to choose the BEST answer.

(1) Winston worked in a pet shop for a long time. Every time he was at work, he was nauseated. Even though he no longer works there, he can't walk by the door of a pet shop without becoming nauseated. Using terms from classical conditioning, the pet shop door has become the_____.

a. unconditioned response
b. unconditioned stimulus
c. conditioned stimulus
d. conditioned response

(2) Andy is allergic to peanuts and vomits whenever he eats one. Andy's brother works in a peanut factory and brings peanuts home every night for several weeks. Eventually, Andy starts feeling nauseated every time his brother comes home. Using terms from classical conditioning, what term best describes the peanuts?

a. unconditioned response
b. unconditioned stimulus
c. conditioned stimulus
d. neutral stimulus

(3) Henry is allergic to pears and becomes nauseated when he eats them. Henry's roommate got a seasonal job at a pear orchard and is now bringing pears home every day for weeks. Eventually, Henry starts feeling nauseated at the sight of his roommate. Using terms from classical conditioning, what term best describes Henry's nausea after eating pears?

a. conditioned response
b. unconditioned response
c. conditioned stimulus
d. neutral stimulus

(4) George's roommate always slams the door when she comes into their dorm room. The noise makes George jump and his heartrate increases. George's roommate has been doing this for months. Eventually, George jumps and his heartrate increases when he simply sees his roommate. Using terms from classical conditioning, what term best describes George's increased heartrate and jumping when he sees his roommate?

a. conditioned response
b. unconditioned response
c. conditioned stimulus
d. neutral stimulus

(5) Wayne's co-worker always punches Wayne in the shoulder whenever he walks by causing Wayne to jump. Using terms from classical conditioning, what term best describes Wayne's co-worker in this scenario?

a. conditioned response
b. unconditioned stimulus
c. unconditioned response
d. neutral stimulus

(6) Sheri wants her husband to go grocery shopping more often. So, when her husband goes grocery shopping, Sheri gives him a massage that week. Soon, her husband goes shopping more. Using terms from operant conditioning, what term best describes what Sheri is using?

a. reinforcement
b. punishment
c. negative reinforcement
d. positive punishment

(7) Gemma wants her husband to rub her feet more. So, when he does, she gives him a kiss. Gemma's husband starts rubbing her feet more often. What form of operant conditioning is Gemma using?

a. positive reinforcement
b. negative reinforcement
c. positive punishment
d. negative punishment

(8) Randy wants his daughter to say, "Excuse me," when she wants to talk to him. So, every time his daughter says, "Excuse me," Randy takes away one of her chores for the week. What form of operant conditioning is Randy using?

a. positive punishment
b. positive reinforcement
c. negative punishment
d. negative reinforcement

(9) Dana wants her son to stop leaving the toilet seat up. So, Dana takes away her son's video games every time he leaves the seat up. Her son soon stops leaving the seat up. What form of operant conditioning is Dana using?

a. positive reinforcement
b. positive punishment
c. negative punishment
d. negative reinforcement

(10) Robin hates when her roommate leaves her clothes all over their dorm room. So, Robin hits her roommate every time she leaves her clothes out. Using terms from operant conditioning, what term best describes what Robin is doing?

a. reinforcement
b. punishment
c. positive reinforcement
d. negative punishment

(11) Drew wants to teach his dog to stop barking. Drew's dog trainer recommends using a shock collar to deliver a shock when the dog barks. Drew's dog trainer is recommending what form of operant conditioning?

a. positive punishment
b. positive reinforcement
c. negative reinforcement
d. negative punishment

(12) A mother is scolding her disruptive child. This ends up increasing the child's misbehavior. Using terms from operant conditioning, what is the best term to describe the scolding?

a. negative
b. positive
c. positive punishment
d. negative punishment

(13) Jon has been skipping school regularly, and his parents want him to stop. So, Jon's parents take away his car, and Jon stops skipping school. Using terms from operant conditioning, what term best describes the action of taking away Jon's driving privileges?

a. positive
b. negative
c. positive reinforcement
d. negative reinforcement

Chapter Excerpt

Operant and Classical Conditioning

Operant conditioning is the learning process in which an action's consequences determine the likelihood the action will be performed in the future. Both reinforcement and punishment can be positive or negative. The designation depends on whether something is given or removed, not on whether any part of the process is good or bad. Through the administration of a stimulus, positive reinforcement increases the probability that a behavior will be repeated. In contrast, negative reinforcement increases behavior through the removal of an unpleasant stimulus.

Punishment reduces the probability that a behavior will recur. It can do so through positive or negative means. Positive punishment decreases the behavior's probability through the administration of a stimulus. Usually the stimulus in positive punishment is unpleasant. Negative punishment decreases the behavior's probability through the removal of a usually pleasant stimulus.

In classical conditioning, a neutral stimulus elicits a response because it has become associated with a stimulus that already produces that response. An unconditioned response is an unlearned, automatic behavior. Similarly, an unconditioned stimulus is a stimulus that elicits a response without any prior learning. Once training has occurred through the pairing of the neutral and unconditioned stimulus, a conditioned response can be elicited. A conditioned response is one that has been learned. Similarly, a conditioned stimulus is one that elicits a response only after learning has taken place.

Intervention Videos

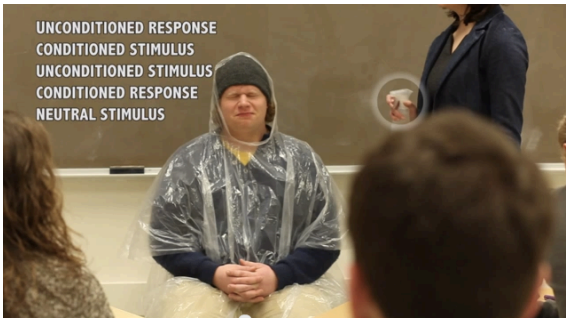
Note: Following each classical conditioning or operant conditioning video, participants were asked the intervention questions on either classical conditioning or operant conditioning terms. Adapted from PSYCHOLOGY IN YOUR LIFE by Sarah Grison, Todd Heatherton, and Michael Gazzanigna. Copyright © 2015 by W.W. Norton & Company, Inc. Used by permission of W.W. Norton & Company, Inc.

Advance-organizer video.

Embedded-guidance videos.

Operant conditioning

Classical conditioning



Control videos.

Operant conditioning

Classical conditioning

Attitude Survey

Please rate the degree to which you agree with the following statements.

1. My overall experience with the quiz was positive.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

2. It was interesting to learn about psychology concepts today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

3. I would be eager to learn about psychology concepts in the same conditions I learned them today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

4. It was motivating to learn about psychology concepts today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

5. It was difficult to learn the psychology concepts in the conditions I learned them today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

6. I had to invest a lot of effort to learn the psychology concepts in the conditions I learned them today.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

7. Using computers is a good idea.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

8. I like using computers.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

9. Computers make work more interesting.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

10. Working with computers is fun.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree